Mulilo Total Hydra Storage Project

Environmental Management Programme for 75MW Badenhorst Solar PV2 on the Remainder of Portion 1 of the Farm 180 De Aar, Northern Cape Province

DEFF Ref Nr: 14/12/16/3/3/2/504

May 2021

Applicant

Mulilo Total Hydra Storage (Pty) Ltd
Top Floor Golf Park 4, Raapenberg Rd, Mowbray, 7700

Contact person:
Top Floor Golf Park 4, Raapenberg Rd, Mowbray, 7700
Contact person: The Director of Solar, Mr Warren Morse
Tel 021 6853240
E-mail : warren@mulilo.com

Compiled by

Landscape Dynamics Environmental Consultants
Environmental Assessment Practitioners: Susanna Nel & Annelize Grobler
Tel 082 888 4060 / 082 566 4530
info@landscapedynamics.co.za

MULILO
RENEWABLE PROJECT DEVELOPMENTS

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HISTORY OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The Environmental Management Programme (EMPR) was originally compiled by *Aurecon South Africa (Pty) Ltd* as part of the application for Environmental Authorisation for the 75MW Badenhorst PV2 Solar Project of the EIA of which the Environmental Authorisation was issued on 8 August 2014.

The following information is supplied for reference purposes :-

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Name	Corlie Steyn	Name	Karen Versfeld			
Title	Project staff	Title	Project leader			

Aurecon South Africa (Pty) Ltd (1977/003711/07
Aurecon Centre, 1 Century City Drive, Waterford Precinct, Century City, Cape Town, 7441
PO Box 494, Cape Town, 8000, South Africa
Tel Number +27 21 526 9400; E-mail address :- capetown@aurecongroup.com

The Draft EMPR was NOT approved as part of the Environmental Authorisation issued on 8 August 2014 (DFFE Registration Number 14/12/16/3/3/2/504).

Landscape Dynamics Environmental Consultants was appointed by Mulilo Total Hydra Storage (Pty) Ltd to:

- Update and finalise the Environmental Management Programme with the relevant requirements from the Environmental Authorisation and subsequent amendments.
- Confirm the final layout and project components of the Mulilo Total Hydra Storage Project of which the 75MW Badenhorst PV2 Solar project forms a part.
- Ensure approval of the EMPR by the Department of Forestry, Fisheries & the Environment.

This report is to be referred to in bibliographies as:
FINAL LIFECYCLE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE 75MW BADENHORST SOLAR PV2 PROJECT ON THE REMAINDER OF PORTION 1 OF THE FARM 180, DE AAR NORTHERN CAPE. DRAFT EMPR COMPILED BY AURECON, 2013 (REPORT NO. 109378/9928). UPDATED AND FINALISED BY LANDSCAPE DYNAMICS ENVIRONMENTAL CONSULTANTS, MAY 2021.

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ABBREVIATIONS

AGST	Above-Ground Storage Tanks
CEMPR	Construction Environmental Management Programme
DFFE	Department of Forestry, Fisheries & Environment
DMRE	Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMPR	Environmental Management Programme
HCMP	Hazardous Chemicals Monitoring Program
kV	KiloVolt
LEMPR	Lifecycle Environmental Management Programme
MTS	Main Transmission Substation
MW	Megawatt
NEMA	National Environmental Management Act (No. 107 of 1998)
NERSA	National Energy Regulator of South Africa
OHSA	Occupational Health and Safety Act (No. 85 of 1998)
OEMPR	Operational Environmental Management Programme
OHPL	Overhead Powerline
PPE	Personal Protective Equipment
PV	Photo Voltaic
RMIPPPP	Risk Mitigation Independent Power Producer Procurement Programme
SANS	South Africa National Standard
SAHRA	South African Heritage Resources Authority
SDA	Skills Development Act (*Act 97 of 1998)*
SHE	Safety, Health & Environment
SKA	Square Kilometre Array

CHAPTER 1: OVERVIEW

This document sets out the Environmental Management Programme (EMPR) for the environmental management of the proposed photovoltaic (PV) solar energy facility, referred to as 75MW Badenhorst Solar PV2 on the Remainder of Portion 1 of the Farm 180, De Aar, Northern Cape Province (DEFF Ref Nr: 14/12/16/3/3/2/504).

1.1 Objective of this document

An EMPR is generally included in the Environmental Impact Assessment Report (EIR) in order to provide a link between the impacts identified in the Environmental Impact Assessment (EIA) Process and the actual environmental management on the ground during project implementation and operation. The purpose of this document is to provide for environmental management throughout the following Lifecycle stages of the proposed development:

- Planning and design,
- Pre-construction and construction,
- Operation, and
- Decommissioning.

The EMPR is therefore referred to as a ***Lifecycle Environmental Management Programme (LEMPR)***.

This LEMPR aims for alignment and optimisation of environmental management processes with conditions of authorisation that may arise, thereby ensuring that identified environmental considerations are efficiently and adequately taken into account during all stages of development.

The LEMPR presented by Aurecon as part of the Application for the Environmental Authorisation for the 75MW Badenhorst Solar PV2 project was NOT approved as part of the Environmental Authorisation issued on 8 August 2014 (DFFE Registration Number 14/12/16/3/3/2/504); therefore Landscape Dynamics Environmental Consultants was appointed by Mulilo Total Hydra Storage (Pty) Ltd to

- Update and finalise the Environmental Management Programme with the relevant requirement from the Environmental Authorisation and subsequent amendments.
- Confirm the final layout and project components of Mulilo Total Hydra Storage Project of which the 75MW Badenhorst PV2 Solar project forms a part.
- Ensure approval of the EMPR by the Department of Forestry, Fisheries & the Environment.

As discussed above, the EMPR aims to address environmental management throughout the project lifecycle, from planning and design, through construction, to operation and potential decommissioning. The EMPR has been structured to include the following sections:

- Chapter 1: Overview giving the background to and objectives of the EMPR
- Chapter 2: Description of project and alternatives.

- Chapter 3: Discussion summarising environmental management influencing the planning and design of the proposed project.
- Chapter 4: Construction EMPR based on identified impacts and mitigation measures from the EIR.
- Chapter 5: Operational Framework based on identified impacts and mitigation measures from the EIR.
- Chapter 6: Monitoring programmes.
- Chapter 7: Erosion management plan.
- Chapter 8: Decommissioning Framework providing guidance on key considerations to be considered during decommissioning/closure.
- Chapter 9: Conclusion

1.2 Legal requirement of the Environmental Management Programme

In terms of the EIA Regulations (Regulation 543 of 18 June 2010) enacted in terms of the National Environmental Management Act (no. 107 of 1998) (NEMA), the proposed project triggers Activity 10, 11 (x and xi) and 18 of Regulation R544 (18 June 2010), Activity 1 and 15 of Regulation R545 (18 June 2010) as well as Activity 4, 14 and 16 of Regulation R546 (18 June 2010).

On 4 December 2014 new EIA Regulations were promulgated and came into effect on 8 December 2014. In terms of the 2014 EIA Regulations, Activity 28, as listed in GN R983, and Activity 15 of GN R984, which are not included in the Listing Notice 1 (GN R545) or Listing Notice 3 of the 2010 EIA regulations, would be triggered by the proposed project. As it is a requirement of Section 53 (3) of the 2014 EIA Regulations, these activities have therefore also been assessed.

The contents of the updated EMPR must meet the requirements outlined in Section 24N (2) and (3) of NEMA and Section 33 of the 2014 EIA Regulations. The EMPr must address the potential environmental impacts of the proposed activity on the environment throughout the project lifecycle including an assessment of the effectiveness of monitoring and management arrangements after implementation. Table 1 lists the latest requirements of an EMPR as stipulated by Section 24N (2) and (3) of the NEMA, 2014 EIA Regulations.

The legislation hereby aims to ensure that effective environmental management is implemented throughout the lifecycle of the project via the translation of EIA management actions into the EMPR. Mulilo Total Hydra Storage (Pty) Ltd, (the Applicant) has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA.

Section 24N (2) and (3) of the NEMA list the latest requirements of an EMPR as given in **Table 1**:-

Table 1: Section 24N (2) and (3) of the NEMA listing the requirements of an EMPR

Legal Requirement ***According to the NEMA 2014 Regulations, Appendix 4, an EMPr must comply with section 24N of the Act and include the information listed below***	***Relevant Pages(s)/ Sections/ Appendices in the EMPr***
(a) details of (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Paragraph 1.4 and Appendix F
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Paragraph 2.1
(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	Figure 4 and Appendix A
(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2
(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2
(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices;	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2

(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Paragraph 1.5 Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2
(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2 Chapter 6
(i) an indication of the persons who will be responsible for the implementation of the impact management actions;	Paragraph 1.5 Paragraph 1.2 and Paragraph 4.2
(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2 Chapter 6
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Construction EMPR: Paragraphs 4.5; 4.6; 4.7; 4.8 and 4.9 Operational EMPR; Paragraphs 5.1 and 5.2 Chapter 6
	Paragraph 4.15

(l) a program for reporting on compliance, taking into account the requirements as prescribed by the regulations;	
m) an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Paragraph 1.7
(n) any specific information that may be required by the competent authority.	In 11 May 2021, Mr Muhammed Essop from DFFE (Division Priority Infrastructure Projects) confirmed that the final layout plan for the MTHS project can be advertised and submitted with the Final EMPR to DFFE for approval.

1.3 Specific Requirement to confirm compliance with Environmental Authorisation and the Draft EMPR

The EMPR is hereby updated to comply with the conditions as per the stipulations in the Planning & Design Phase and the Draft EMPR compiled by Aurecon initially in November 2013. The EMPr was also updated by Landscape Dynamics in October 2020 to include the requirement associated with the addition of a Battery Energy Storage System (BESS) to the project components.

The Environmental Authorisation and EA Amendment Applications include the following (refer to Appendix B) :

DFFE Document, Date & Reference Number	Document Description
Environmental Authorisation (EA) Date issued : 8 August 2014 Reference Number : 14/12/16/3/3/2/504	• Authorisation of relevant listed activities in terms of the 2010 EIA Regulations in terms of NEMA
EA Amendment Date issued : 3 May 2017 Reference Number : 14/12/16/3/3/2/504AM1	• Change of Contact Details of the Badenhorst Solar PV2 (Pty) Ltd • Amendment to the property description
EA Amendment Date issued : 24 August 2020 Reference Number : 14/12/16/3/3/2/504AM2	• Extension of validity period of EA up to 8 August 2024.
EA Amendment Date issued : 15 February 2021 Reference Number : 14/12/16/3/3/2/504AM3	• Inclusion of BESS in project description
EA Amendment Date issued : *In process* Reference Number : 14/12/16/3/3/2/504AM4	• Change of Applicant name from Mulilo Renewable (Pty) Ltd to Mulilo Total Hydra Storage (Pty) Ltd

During a Pre-Application Meeting held with DFFE on 18 March 2021, the following was confirmed in terms of the EMPr for the **75MW Badenhorst Solar PV2** facility:

- The EMPR and final project layout must be updated as per the EA conditions and the stipulations in the Planning & Design Phase of the EMPr.
- It must be distributed for a 30-day commenting period to Key Stakeholders and Interested & Affected Parties.
- Once the comment from the key stakeholders had been integrated with the EMPR, it must be submitted to DFFE for approval as a single application. A 30-day DFFE decision-making period is applicable.

The following studies, assessments and specifications were identified as per the EA and EMPr requirements to ensure a comprehensive Environmental Management Programme is provided:

- Flood Impact Assessment
- Stormwater Management Plan
- Erosion Management Plan
- Site Clearance Plan
- Aquatic
  - Impact Ground-Truthing Walk-Down Survey
  - Water Use Authorisation
  - Application for GA
- Terrestrial Ecology :-
  - Terrestrial Ecology Walk-Down Survey
  - Plant Rescue Management Plan
  - Alien Invasive Plant Species Management Plan
  - Vegetation Rehabilitation Plan
  - Proof of Submission of Flora Permit Application
- Avifauna (Current Bird Monitoring Programme implemented)
- Heritage Confirmation Letter
- Socio-Economic: Local Training and Skills Development Plan
- Traffic :-
  - Traffic Management Plan
  - Transport Management Plan
  - Wayleave Application / Approval from SANRAL
- Hazardous Chemicals Monitoring Program
- Battery Energy Storage Systems
  - iSHEcon BESS Safety, Health and Environmental Risk Assessment Report
  - BESS Fire Standards and Risk Engineering Standards
- Emergency Response and Fire Management Plan

Table 2 Summary of requirement of the EA and Draft EMPR

Condition in the EA dated 8 Aug 2014	Conditions in the Environmental Authorisation	Included in the Final EMPR
12	Final Development Layout Plan (inclusive of all project components and made available for public comment prior to submission of the layout plan to DFFE for approval)	Appendix A
13	A Shapefile to be provided in a specific format once the layout has been approved	To be provided once layout (part of the EMPR) has been approved
14	EMPR to be updated, communicated and submitted for approval by DFFE	The entire document
14	Final development layout plan to be communicated with IAPs for a 30-day response period and submitted to DFFE for approval (it can form part of the EMPR)	Appendix E
19.1	All recommendations and mitigation measures recorded in the EIR	Entire document
19.2	All mitigation measures of specialist reports to be included in the Final EMPR	Appendix D
19.3	Al requirements of the EA to be integrated with the Final EMPR	Entire document
19.4	Final site layout map	Appendix A
19.5	Alien Invasive Management Plan	Appendix D(f)(iii)
19.6	Plant Rescue and Protection Plan	Appendix D(f)(ii)
19.7	Re-vegetation and Habitat Rehabilitation Plan	Appendix D(f)(iv)
19.8	A Traffic Management Plan	Appendix D(k)(i)
19.9	A Stormwater Management Plan	Appendix D(b)
19.10	An Erosion Management Plan	Appendix D(c)
19.11	Hazardous Monitoring System	Appendix D(l)
19.12	Protection of hydrological features	Appendix D(e) and mitigation in this EMPR
19.13	Environmental Sensitivity Map	Appendix A
19.14	Final Development Layout Plan to be superimposed on the Environmental Sensitivity Map	Figure 5 and Appendix A

Conditions in the previous EMPR which had not yet been approved (conditions not already included in above table)	Included in the Final EMPR
A Flood Impact Assessment	Appendix D(a)
Aquatic Ground-Truthing for the BESS site	Appendix D(e)(i)
Water Use Authorisation	Appendix D(e)(ii)
Terrestrial Ecology Walk-down Survey	Appendix D(f)(i)
A Transport Management Plan	Appendix D(k)(ii)
Wayleave Application/Approval with SANRAL	Appendix D(l)(iii)
BESS Requirement	Appendix D(m)

1.4 Expertise of Environmental Assessment Practitioners

Section 33 of EIA Regulations and Section 24N (2) and (3) of the NEMA requires that an EMPR must include the details and expertise of the person(s) who prepared the EMPR. The *Curriculum Vitae* of the Environmental Assessment Practitioners who compiled this Final LEMPR are included in **Appendix A**.

This Draft Lifestyle Environmental Management Programme (LEMPR) was compiled by Aurecon in 2014, but Landscape Dynamics Environmental Consultants subsequently updated the Draft EMPR to include the mitigation and management measures of the BESS component. Landscape Dynamics was appointed to update and finalise the EMPR for approval by DFFE.

Landscape Dynamics is an environmental consultancy firm established in May 1997. The main line of business since that time up to the present is the compilation of environmental impact assessments. Landscape Dynamics has a broad client base from both the private and government sectors which has developed over the past 23 years of professional services supplied. The operating base for Landscape Dynamics is the entire South Africa; with local representation in Gauteng, the North West Province, Mpumalanga, the Western Cape, the Northern Cape and Limpopo. The Environmental Assessment Practitioners (EAPs) for this project are Ms Annelize Grobler and Ms Susanna Nel. Both EAPs are EAPASA registered. Refer to Addenda A of this EMPR for a Company Profile and condensed Curriculum Vitae's of the EAPs.

1.5 Key Role Players and Responsibilities

Mulilo Total Hydra Storage (Pty) Ltd

The developer (MTHS) will be

- be responsible for the overall implementation of this Environmental Management Programme (EMPR).
- ensure that all third parties (i.e. Contractors; suppliers, etc.) comply with the requirements of this EMPR.

Appointment of Contractors

- The relevant specifications of the EMPR with all its appendices must be included in all contracts with the Contractors.
- Only contractors with sound and proven environmental performance should be considered.

Environmental Control Officer

- An independent Environmental Control Officer (ECO) must be appointed by MTHS prior to commencement of construction and DFFE must be notified of such an appointment
- The key responsibility of the ECO is to ensure that all the conditions stipulated in this EMPR are being adhered to. He/she should monitor and oversee project compliance with the conditions of the environmental authorisation, water use authorisation, permit requirements and all relevant and associated environmental legislation as described in the EMPR.

- The ECO must liaise with the Contractor and MTHS and attend site meetings where applicable and inspect the construction site on a regular basis to ensure that the mitigation and rehabilitation measures are applied. The frequency of the site visits and meetings will be determined during the kick-off of the project.
- The ECO might make reasonable and relatively minor amendments (supported by sufficient motivation) to the EMPR in co-operation with the contractor and the Applicant where required. Any significant changes will however have to be communicated with and approved by DFFE according to relevant legislation.
- The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to the Applicant by the contractor for the operation.
- The ECO must compile monthly site audit reports and an environmental audit report on completion of the project. All the monthly and final audit reports must be submitted to DFFE.
- The ECO will be responsible for the compilation and presentation of an ***Environmental Awareness Programme*** to all Contractors. Reasonable and effective ways to communicate this must be identified for the specific attendees (i.e. in terms of communication method; material and complexity of information). The Environmental Awareness Programme will include the following:-
    - Communication of key project components
    - A basic summary of the relevant environmental policies, procedures, plans and systems;
    - The significant environmental impacts, actual or potential, which could result from their work activities;
    - Communicate by means of photos what the two protected plant species look like and their removal requirement (in case it was missed during the site clearance).
    - The roles and responsibilities in achieving conformance with the environmental policy and procedures, including emergency preparedness and response requirements;
        - The potential consequences of departure from specified operating procedures
        - The mitigation measures to be implemented when carrying out their work activities;
        - The importance of not littering;
        - The need to use water sparingly;
        - Details of, and encouragement to, minimizing the production of waste and re-use, recover and recycle waste where possible;
        - Details regarding archaeological and/or historical sites which might be unearthed during construction and the procedures to be followed should these be encountered.
    - Record of attendance of these awareness meetings must be kept.

Note that the ECO will not replace the Safety and Health (SHE) Officer who must be appointed by MTHS separately from the ECO to ensure compliance with all matters relating to the Occupational Health and Safety Act (No. 85 of 1998).

CHAPTER 2: BACKGROUND INFORMATION

This section outlines how environmental considerations have informed and been incorporated into the planning and design phases of the proposed PV facility. Detailed design is usually undertaken as part of the pre-construction phase as it is a costly undertaking which is generally only costed for once all required authorisations have been obtained. Thus, the planning and design phases discussed are limited to those associated with the pre-authorisation phases. Mitigation measures have been recommended for the detailed design phase.

2.1 Project Description

Mulilo Total Hydra Storage (MTHS) on the Remainder of Portion 1 of Farm 180, De Aar : Update and Finalisation of the Environmental Management Programmes for the following projects:

- **75MW Badenhorst Solar PV2 – *the subject of this EMPr***
- 75MW Badenhorst Dam Solar PV3
- 100MW Mulilo De Aar PV

In accordance with the ministerial determination as gazetted on the 7th of July 2020, the Minister of Mineral Resources and Energy, in consultation with the National Energy Regulator of South Africa has determined that the Department is to procure 2000 MW of new generation capacity from a range of energy source technologies. The Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) has been designed by the Department in order to fulfil the Minister's directive. The Applicant for the above-mentioned project is Mulilo Total Hydra Storage (Pty) Ltd (MTHS). They have received Preferred Bidder Status on 18 March 2021 in terms of the RMIPPPP.

The Project is located 5km south east of De Aar in the Northern Cape and roughly 8km north of the Eskom Hydra Transmission Substation in the Northern Cape Province. The Project is split over three sites located adjacent to one another on the Remainder of Portion 1 of the Farm De Aar Nr 180.

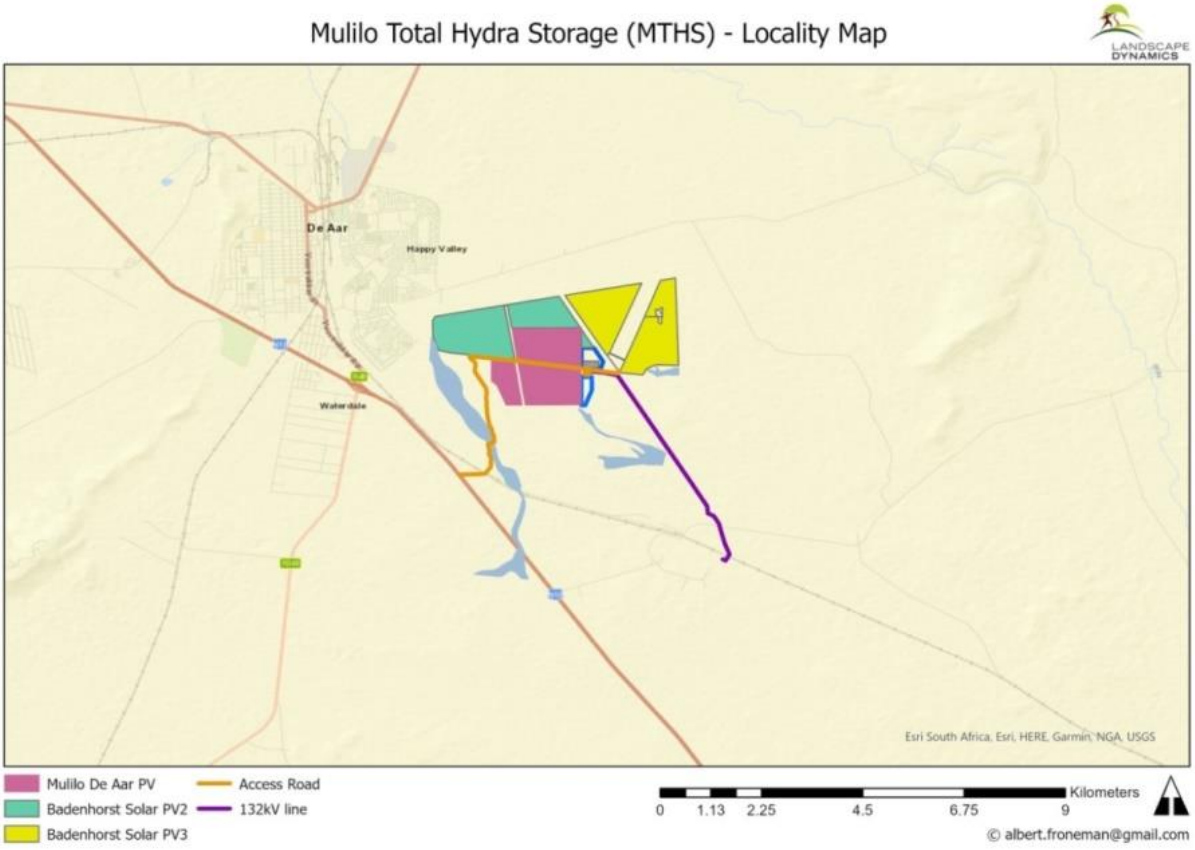

Figure 1: ***Locality Map***

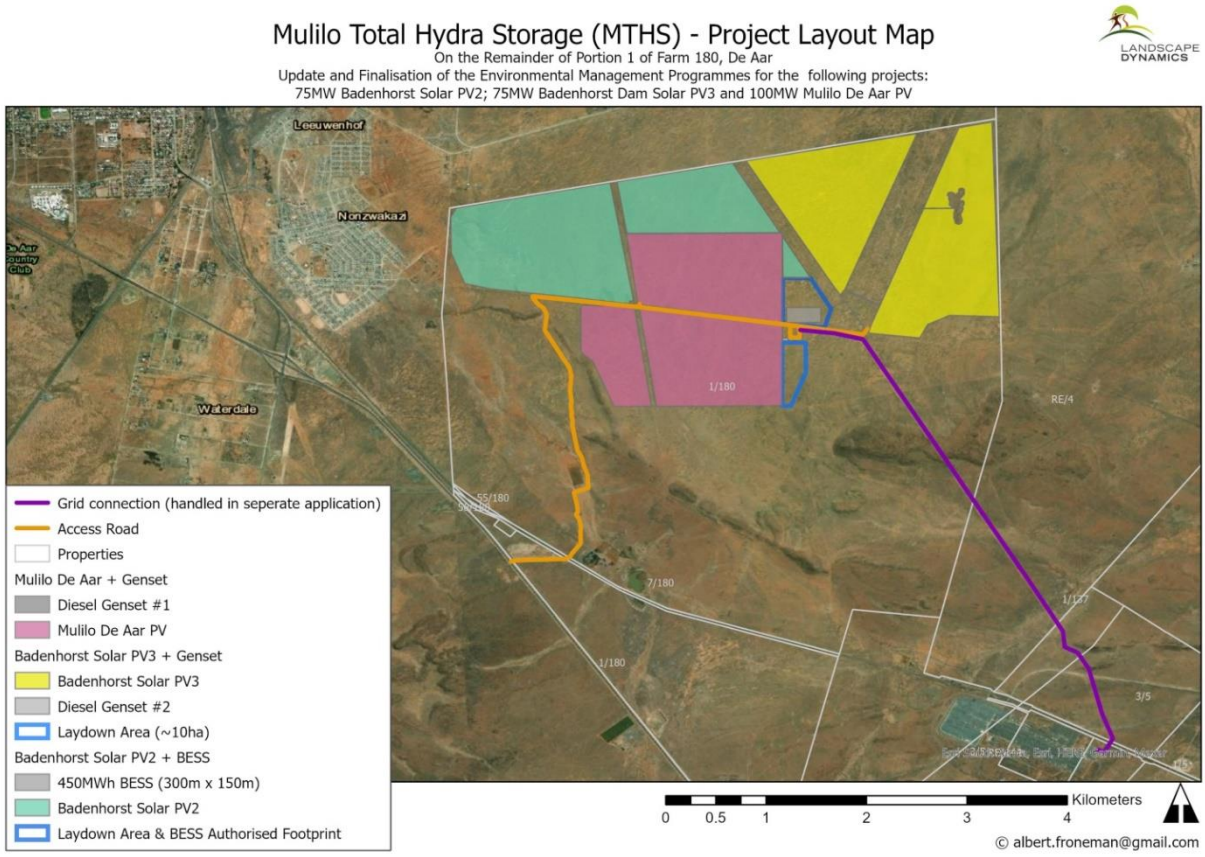

Figure 2: ***Diagrammatical Development Layout of the MTHS Project***
(Refer to Appendix A for the detailed Final MTHS Layout overlain on the Site Sensitivities Map)

Facility	Footprint	Capacity	Coordinates of middle point
Badenhorst Solar PV2	240ha	75MW	30° 40'02.24"S 24° 03'06.74"E

Table 3: Footprint, capacity and coordinates of 75MW Badenhorst Solar PV2

The following main infrastructure associated with the **MTHS solar facility of which 75 MW Badenhorst PV2 forms a part**, includes the following:

- **A photovoltaic component** comprising of many rows of Photovoltaic (PV) panels and associated support infrastructure as discussed below to generate up to 75MW through the PV effect. Associated support infrastructure will include access roads (main and internal), a potential water pipeline for potable water, boundary fence (electrical or barbed wire) around the PV facility, and stormwater infrastructure.
  The Project is a hybrid of technologies which is primarily supplied by solar photo-voltaic technology, an AC coupled lithium-ion battery and emergency backup Diesel/Gas generator engines.
  - The solar portion is split over 3 x environmentally authorized footprints located adjacent to one another and forming a combined total installed capacity of 216 MW peak (DC).
  - The BESS is to have an (AC) energy capacity of 450 MWh, 150 MW charging capacity and 75 MW discharging capacity at the Delivery Point.
  - The BESS is not allowed to be charged from the national grid so 2 x 9.9 MVA Diesel / Liquified Natural Gas generator installations are included in the design to provide backup power supply to the BESS following rare instances of extended periods of low radiation.
  - Components imported to South Africa will be via the Port of Ngqura, with the Port of Saldanha considered as the alternative option.

- **Central substation:** One 132kV substation central to Remainder of Portion 1 of the Farm De Aar 180 with a connection to the Eskom Hydra Main Transmission Substation.

- An **overhead powerline (OHPL)** is needed to evacuate electricity generated from the Mulilo Total Hydra Storage Project and will be approximately 8km in length, with a capacity of up to 132kV. The proposed OHPL follows the existing 132kV Hydra Bushbuck (Solar Capital) OHPL for the most part and will run in a south easterly direction to the Eskom Hydra Main Transmission Substation (MTS). *This powerline route is the subject of a separate application and does not form part of this EMPr.*

- **Additional infrastructure:** This would include access roads (main and internal), a potential water pipeline for potable water, a boundary fence (electrical or barbed wire) and stormwater infrastructure.

- **Laydown area:** This area will be used to store equipment and materials and house the construction camp. Temporary offices will also be constructed to manage construction activities from a central point.

- **Battery Energy Storage System (BESS)**
  The BESS site is situated within the authorised laydown area of approximately 19.6 hectares. The final footprint of the BESS is likely to be significantly less. The total MTHS authorised laydown area is 70.2 hectares in size and will be large enough to house the BESS for the total MTHS project; as well as construction activities for all three the solar PV plants.
  The BESS will comprise of multiple battery units or modules housed in shipping containers and/or an applicable housing structure which is delivered pre-assembled to the project site. Containers are usually raised slightly off the ground and can be stacked if required. Supplementary infrastructure and equipment may include power cables, transformers, power converters, buildings & offices, HV/MV switch gear, inverters and temperature control equipment that may be positioned between the battery containers.
  The BESS has the following high level characteristics
    - Footprint area required: <20 hectares (approximately 440m x 440m)
    - Height: Battery Array <10m
    - Height: Substation & Powerline <25m
    - Voltage <132kV
    - Power Output ~150MW
    - Energy Capacity ~2500MWh
    - Chemistry Lithium Ion (All NMC, LCO, LMO, NMC, LFP, NCA, LTO)
    - Charge & Discharge Duration 5-16 hours

- **9.99MW Auxiliary Generators** – there are two Diesel/Gas Generator Installations (Gensets) planned within the laydown area of 75MW Badenhorst Dam Solar PV3 and within the footprint of 100MW Mulilo De Aar PV solar site. The genset sites are approximately 2 500m^2 in size each.
  Each Installation contains 11 individual generators, housed in a pre-assembled units of similar proportions to a 20ft ISO shipping container, with dimensions length (6.06m); width (2.44m) and height (2.6m).
  The GENSET facility is not planned to be constructed on the 75MW Badenhorst Solar PV2 project area and therefore, impact and mitigation associated with fuel storage facilities do not form part of this EMPR.

- **Two Fuel Storage Facilities** are planned to provide diesel to the GENSETs:-
  Badenhorst Dam Solar PV3 will accommodate fuel storage tanks of a combined storage capacity of less than 80m^3 within the authorised footprint of the laydown area. The other storage facility will be accommodated on the Mulilo De Aar PV site with a combined storage capacity of up to 500m^3, within the authorised PV footprint area.
  No fuel storage facilities are planned for the 75MW Badenhorst PV 2 project area; therefore, impact and mitigation associated with fuel storage facilities do not form part of this EMPR.

- The **Access Road** involves the upgrade of an existing access road to a 12m wide access road servitude off the N10 Highway and traverse a Transnet railway line before traversing over the leased Farm De Aar 1/180.

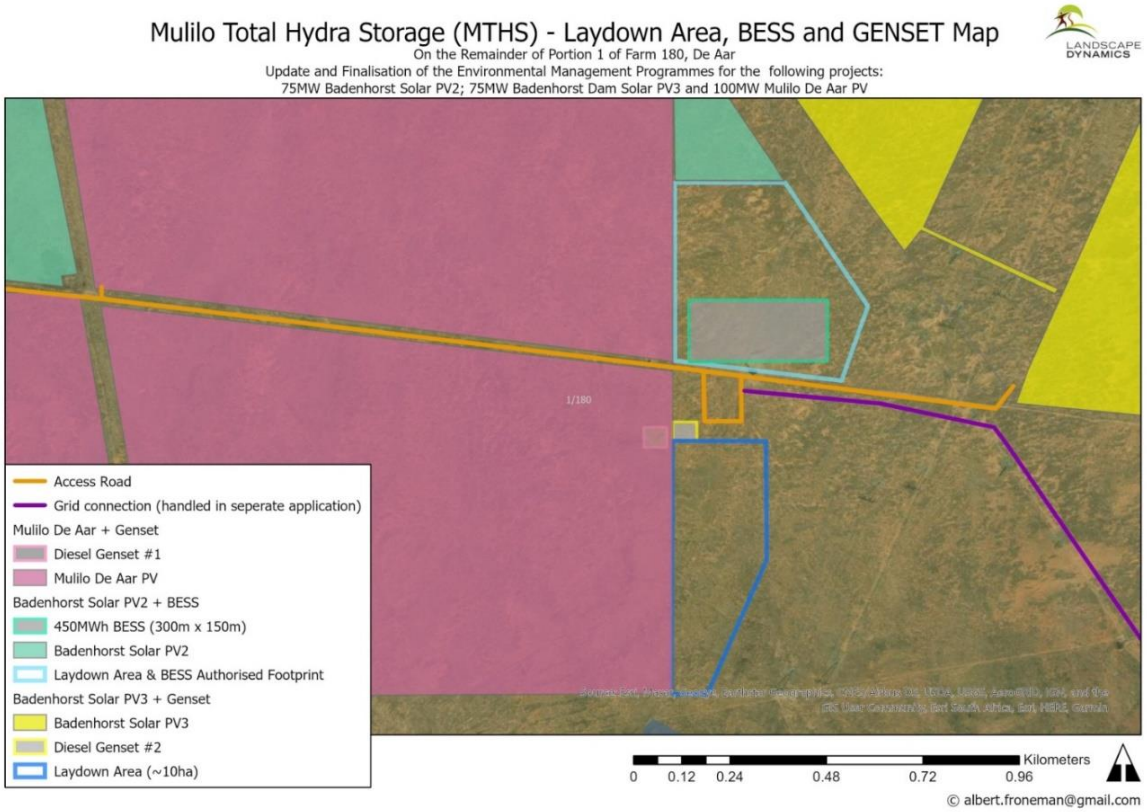

Figure 3: The MTHS Laydown Area indicating the BESS and the GENSET facilities

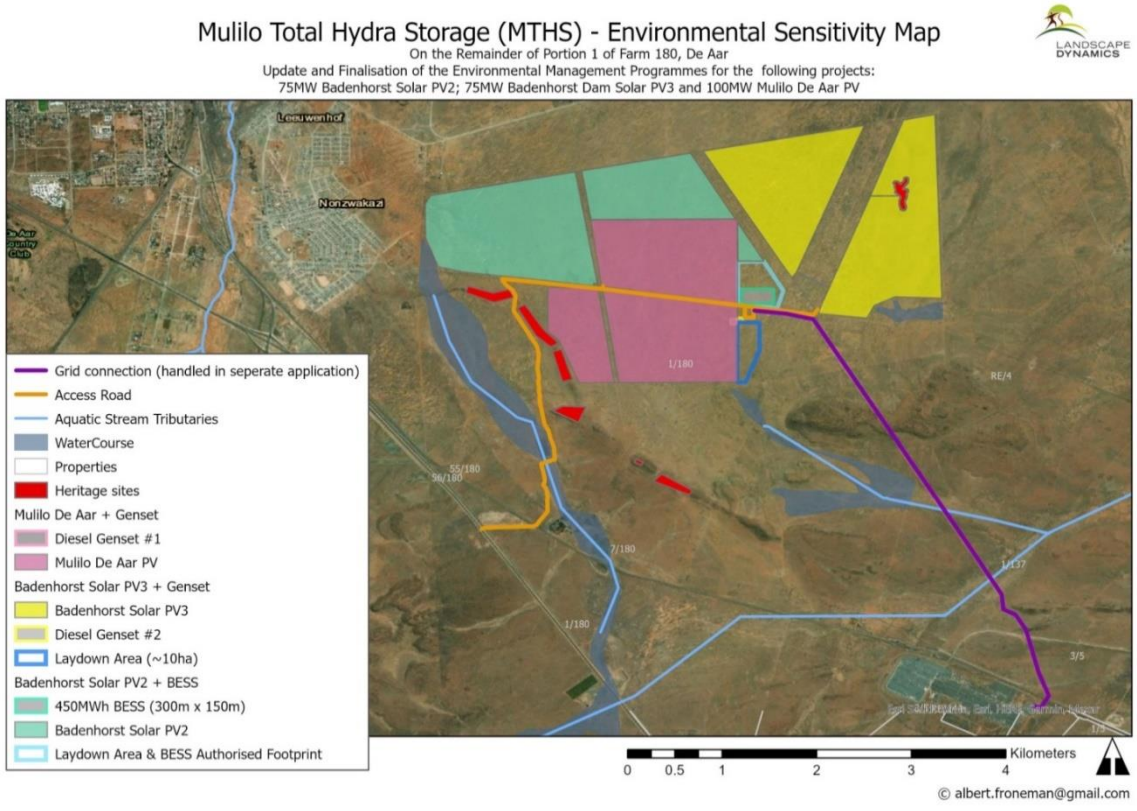

Figure 4: Diagrammatical MTHS Layout with Environmental Sensitivities
(Appropriate detail project components is included in Appendix A as the the Final MTHS Site Layout)

CHAPTER 3: PLANNING AND DESIGN PHASE

The design for the proposed development should respond to the identified environmental constraints and opportunities. The following mitigation measures related to the design for the proposed development have been recommended to reduce the environmental impacts.

3.1. Plans, policies, programmes and permits required for the planning and design phase

During the planning and design phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMPR. Table 2 below provides a quick reference list of these requirements.

Table 1: Plans and permits required for the Planning and Design Phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Plant Rescue and Protection Plan	Has been compiled and is included as Appendix D(f)(ii) to be implemented during the planning phase
Flora	Permit Application	The application has been submitted to the Northern Cape Nature Conservation Services – Proof is supplied in Appendix D(f)(vi)
Flora	Vegetation Rehabilitation Plan	Has been compiled and is include as Appendix D(f)(iv) to be implemented during the construction and operational phase
Flora	Open Space Management Plan	Has been compiled and is include as Appendix D(f)(v) to be implemented during the construction and operational phase
Flora	Alien Invasive Plant Species Management Plan	Has been compiled and is include as Appendix D(f)(iii) to be implemented during the planning phase
Avifauna	Pre-construction monitoring as part of the long term avifauna monitoring programme	In process. Section 6 of this LEMPR includes details of the avifaunal monitoring programme.
Heritage	Desktop examination is required to compare final layout with heritage sites	A Heritage Letter is included in Appendix D(h)
Palaeontology	No fossil permit is required.	A PIA Statement letter is attached as Appendix D(i)
Socio-Economic	Local Employment policy and training programme	Has been compiled and is included as Appendix D(j) to be implemented during the planning phase, construction and operational phases.
Surface water	Stormwater management plan	A Stormwater Management Plan is included as Appendix D(b)in Annexure

		C of LEMPR
Roads	Traffic Management Plan and Transport Management Plan.	Have been compiled and is included as Appendix D(l)(i) and D(l)(ii) to be implemented during the construction and operational phases..
	Permits for any abnormal loads.	No Abnormal Loads are currently required. Should this change and abnormal loads be required, then permits will be obtained.
	Design of new access roads.	The detailed design of the new access roads must be undertaken by a professional engineering consultant or professional engineering technologist, registered with the Engineering Council of South Africa. The plan must be submitted to SANRAL for approval.
	Wayleave application for construction of the access road and transmission lines within the 60m buffer zone from the N10.	The access road and transmission lines would be constructed within the 60m buffer zone. The developer must finalise the wayleave application prior to commencement of construction. Refer to Appendix D(k)(iii).
Sedimentation and Erosion	Erosion Management plan	Included in Section 6 of the LEMPR

3.2. Mitigation measures

3.2.1 Terrestrial Ecology

Terrestrial Ecology Walk-Down Survey

The site walk down was undertaken in March 2021 (18 March to 19 March), refer to Appendix D(f)(i). The entire footprint of all proposed infrastructure was walked on foot. Photographs were taken at regular intervals, and included different parts of the project area. Plant species checklists were compiled, and any plant species of interest anywhere within infrastructure was also recorded. Particular attention was paid to recording the locations of any protected species seen on site. The protected species list includes common and widespread species, so only an indication of the overall distribution of these was recorded as it was not possible to record the location of every plant. Attention was paid to the location of any habitat identified during the EIA as being of high sensitivity.

On the basis of the walk-down by Dr David Hoare, no sensitivities have been identified within the footprint of proposed infrastructure, except for drainage areas already identified during the EIA, which are being avoided for the proposed layout.

A risk assessment was undertaken to evaluate the possibility of other protected species occurring in the area. A small number of species were identified that could possibly occur in the area but for most of these they are conspicuous enough to have been seen on site, or the site does not contain the type of habitat in which they are usually found. Some geophytes

were identified that would be expected to occur in the area, but dormancy is not considered to be a factor, because site conditions at the time of the survey and the season of the survey were good for detecting all species.

The recommendations in terms of the following plans provided in Appendix D(f)(i)-(vi) must be implemented :-

Plant Rescue Management Plan

The following monitoring activities are generally recommended as part of a plant rescue plan:

- Post-relocation monitoring of plants relocated during search and rescue to evaluate whether the intervention was successful or not. This should be undertaken on an annual basis over a period of three years in order to evaluate the success thereof.
- Provision of a detailed record, including photographs, that indicates the success of the plant rescue operation.

Indicators and Targets

Indicator	Target
Written and photographic records from all all search and rescue operations.	All species of conservation concern identified or removed prior to clearing.
Survival rate of translocated plants	50-80% (based on probable survival rate of grassland species)

Currently, only a flora permit is required for destruction of individuals of two plant species for which rescue is not considered appropriate.

Alien Invasive Plant Species Management Plan

A recent biodiversity survey on site identified various natural plant communities on site and in adjoining areas and rated these according to their biodiversity importance. Within the current general area are various karroid dwarf shrub land and ridge vegetation communities that have been identified as having moderate to high biodiversity importance. These represent key biodiversity areas associated with the site that should be protected, including preventing them from becoming degraded from alien invasion.

Key vulnerabilities to invasion on site include the following:

- Natural vegetation on site, which includes some indigenous biodiversity within the study area;
- Moderate levels of disturbance in parts of the site that act to increase the probability of alien invasive species become established and spreading;
- Neighbouring urban areas that may potentially act as a source of invasive alien species on site.

There are various overall strategies to be taken into consideration in compiling an eradication programme. These include the following:

- Controlling alien invasive species, although a legal requirement, is usually a means to achieving a higher goal, such as protecting biodiversity, rehabilitating disturbed areas, restoring ecological functionality, preventing economic loss, protection of human health, etc. Alien invasive clearing should therefore be aligned with the broader biodiversity targets and strategy for the project.
- Different species require different control methods.
- It is important to break the reproductive cycle of a species.
- There should always be follow-up of clearing to prevent invasive species from becoming re-established in areas that were previously cleared.
- The size of the area being cleared should always be manageable.
- In principle, start in the least-invaded areas and work towards the heavier infestations. This will make it possible to safeguard relatively large areas of natural habitat.
- Clearing should always start at the highest point in the landscape and work downwards.
- Cover any exposed soil with plant material, but ensure that this is free of seeds of the invasive species or other propagules.
- If possible, try to clear plants before they produce seeds by cutting them back before they flower.
- Do not transport seeds, fruits, bulbs, tubers or stems that root easily from one site to another. It is best to burn material where it is cleared, if possible.
- Follow-up is essential. This is linked to ongoing monitoring to detect alien seedlings and remove them while they are easy to manage and also to progressively deplete the soil seed-bank.
- Rehabilitation or restoration of cleared areas is necessary to restore ecological functionality and to create conditions that are less favourable for invasive species.
- As alien invasive species impact on the condition of habitats and populations of species, their control or eradication, as appropriate, should be undertaken to increase the overall positive biodiversity footprint of the project, in line with an overall biodiversity strategy.

Within the proposed footprint area, only two listed alien invasive species was recorded on site, *Opuntia engelmannii* (Category 1b) and *Datura ferox*. Approximately 10 plants of the *Opuntia* were observed on site, scattered throughout the site but mostly associated with boundary fences and existing power lines. Only 1 plant of the *Datura* was seen on site, at the water hole.

Vegetation Rehabilitation Plan

The re-application of topsoil and cleared vegetation (as mulch) will be sufficient for rehabilitation at this site. However, the ECO can consider, as an option, to collect indigenous seed to sow. This measure is therefore not required, but is a possibility, if found necessary. If needed, indigenous seed can be collected from plants present on site, and should be used immediately, or stored appropriately, and used at the start of the following wet season. Seed can be broadcast onto the soil but should preferably be applied in conjunction with measures to improve seedling survival, such as scarification of the soil surface, or simultaneous application of mulch.

The following principles apply:

- Indigenous seeds may be harvested for the purposes of re-vegetation in areas that are free of alien invasive plants, either at the site or prior to clearance of vegetation from suitable neighbouring sites.
- Seed may be harvested by hand and, if necessary, dried or treated appropriately.
- Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs, or from plant litter surrounding the shrubs, must be kept apart from individually harvested seed.
- No alien or foreign species seed is to be used or brought onto the site.

As a principle, the mixture of seeds should include the following:

- A mixture of annual and perennial plants.
- Includes pioneer species.
- Selected species must be able to grow in the area where they are being used.
- Roots must have a binding effect on the soil.
- The final mixture must not cause an ecological imbalance in the area.

The following soil, wetland and vegetation management measures are proposed to aid in limiting impacts, as well as to assist with successful rehabilitation:

- Soil must only be stripped from areas that are to be disturbed during construction or maintenance and not from any adjacent or other areas.
- Erosion control measures must be included in the design of linear infrastructure.
- Vehicles must be restricted to travelling only in designated roadways to limit the ecological footprint of the proposed development activities.
- All disturbed areas must be rehabilitated using stockpiled soils, as required.
- Ecologically sensitive areas must be rehabilitated where they have been damaged by construction activities.
- The extent of all local construction sites must be demarcated, and no vegetation is to be removed outside of this zone.
- If vegetation is to be cleared on site, erosion control measures must be kept in place to ensure that excessive scarring of the landscape is limited.
- Adequate storm water management must be incorporated into the design of the project in order to prevent erosion.
- Stripping and clearing of vegetation must ideally be planned to be done during the dry season.
- Should any construction activities occur within a 1 in 100-year flood line or within 500 m of a watercourse, the relevant authorisation should be obtained according to the National Environmental Management Act (NEMA) 107 of 1998 and Section 21 c and i of the National Water Act 36 of 1998, respectively.
- No structures are to be constructed within the riparian areas or within the active stream channel as far as possible. If at all possible, all support structures should be developed above the 1:100-year flood line. Or, if that is not possible, above the 1:50 year flood line.
- Sensitive areas in the vicinity of construction works must be fenced for the duration of the construction phase and designated a ‘no-go’ area.

- Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible. Rehabilitation of disturbed areas should therefore be carried out concurrently with construction, as far as possible. Current disturbed footprint areas must be kept to a minimum.
- Once re-vegetated, areas should be protected to prevent trampling and erosion.
- No construction equipment, vehicles or unauthorized persons should be allowed onto areas that have been re-vegetated.
- Any runnels, erosion channels or wash-aways developing after re-vegetation should be backfilled and consolidated to restore them back to a proper condition.
- Material removed from the excavation that is not suitable or not required for backfill may be spread evenly over the disturbed area. However, spreading of subsoil is not permitted.
- The local topography must be returned to as close to its original state as possible. If possible, sites should not be levelled.
- Where necessary, re-vegetation can take place using seed, rescued plant material, or mulching. Where the affected area is less than 1 m across, passive re-vegetation can be employed, where natural ecological processes are relied upon to promote vegetation growth, but it is preferable to actively restore vegetation cover, as this reduces the risk of erosion.
- Compacted ground must be rehabilitated by ripping to a minimum depth of 600 mm.
- Rock piles should be deployed in a heterogenous way to mimic habitat variability on site.

A useful approach is to also collect photographic records of all plant species for reference purposes. These can be posted onto a citizen-science website, such as iNaturalist (https://www.inaturalist.org), where identifications can be obtained from other botanists. This is an alternative method to collecting physical herbarium specimens for species identification purposes and also provides verifiable records of species that were encountered.

The following monitoring is required during the **construction phase** of the project:

Monitoring action	***Indicator***	***Timeframe***
Photographs of area prior to construction	Baseline condition / pre-construction state	Pre-construction

The following monitoring is optional during the **operational phase** of the project:

Monitoring action	***Indicator***	***Timeframe***
Document rehabilitation measures implemented, and success achieved in problem areas	Decline in vulnerable bare areas over time	Annually
Vegetation monitoring (as described in the text above)	Species compositional change over time	Annually

Open Space Management Plan

The objective of an Open Space Management Plan is to ensure that remaining natural and/or open space and semi-natural areas within and adjacent to the development site are ecologically managed during construction and operational phases of the project.

The Open Space Management Plan cannot be considered independently of the other environmental management plans, in particular, the Open Space Management Plan should align with the Stormwater Management Plan (which specifies erosion management), Rehabilitation Management Plan, and Alien Invasive Management Plan.

Specific requirements are the following :-

Access control

- Access to the facility should be strictly controlled; all visitors and contractors should be required to sign in before entering the premises.
- Signage should be placed at the entrance to indicate that disturbance of the fauna and flora species is strictly prohibited.
- No hunting, collection or disturbance of the fauna and the floral species is allowed unless required for safe operation of the facility and in possession of the appropriate permits and landowner's permission to do so.
- No driving off the demarcated roads should be permitted, except in exceptional circumstances.
- Restricted areas are off-limits, except for specific management purposes.

Fire management

Fires are not a regular occurrence at the site. However, fires may occasionally occur under certain circumstances. Ignition risk sources in the immediate area include:

- Lightning strikes;
- Personnel within the facility; and
- Infrastructure, such as transmission lines.

The following fire-management activities should take place:

- Contactor to ensure that the appropriate equipment as well as trained personnel are available to combat fires.
- The management of the facility should ensure that they have suitable equipment as well as trained personnel available to assist in the event of fire.
- The Contractor shall ensure that the employees are aware of the procedure to follow in the event of a fire.
- Extensive firebreaks are not recommendation as the fire management strategy.
- The service roads within and around the facility will serve to break up the connectivity of the vegetation and serve as the firebreak which would retard the spread of fire around the site. In case, alien species colonize the area, more regular clearing should be implemented.
- The reduction of the biomass within the facility would be through the use of the livestock grazing. The compatible livestock for grazing in such facilities are small stock such as sheep and the area can be grazed once or twice a year depending on the rainfall.In case the

vegetation is too tall, and grazing is not possible, vegetation should brush-cut and the excess material raked up and removed if necessary.

- Additional fire management should be according to national legislation related to fire protection and Fire Management Agencies, and in co-operation with measures in place by the landowner and Eskom (transmission powerlines), for example required firebreaks.

Ecological process areas

To ensure the protection of ecological process areas, the following mitigation measures are recommended:

- All works to be undertaken shall be within the boundary of the site.
- A "no-go" area shall extend on either side of the working area (i.e., all areas outside of the defined working area and designated access and construction roads).
- No equipment associated with earthworks shall be allowed outside of the working area and defined access and construction roads or within "no-go" areas, unless expressly permitted by the Environmental Control Officer / Engineer.

Prohibited activities

The following activities should not be permitted by anyone expect the landowner or his representatives:

- No fires within the site.
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Control Officer on duty with the appropriate permits and landowner permission.
- No domestic pets or livestock are permitted on site.
- No driving off of demarcated roads.
- No interfering with livestock.
- No use (e.g. swimming or washing of clothes or machinery) of any natural water resource.
- No marking / painting or any natural features (e.g. rock formations).

Monitoring programme

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of the open/rehabilitated areas. During the construction phase, the ECO and contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project company will need to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

Flora Permit Application

No plant species were found on site that is protected according to the National Environmental

Management: Biodiversity Act, 2004 (Act 10 of 2004) (see Appendix 2). The only one likely to occur on site is *Hoodia gordonii*, a relatively conspicuous plant that would have been easily seen if it occurred there.

A permit is however required for the destruction of two protected species (for which rescue is not an option). These plants are protected under Schedule 2 of the Northern Cape Nature Conservation Act No. 9 of 2009. Note that both of these are widespread and relatively common species (the first is an indigenous weed of disturbed places) but both are from the Family *Mesembryanthemaceae* (now called *Aizoaceae*). They are the following:

Proof of submission of the permit application to the Northern Cape Nature Conservation is included Appendix D(f)(vi).

Mestoklema tuberosum

Mesembryanthemum junceum

3.2.2 Terrestrial Fauna

- Allow small ground level openings, 20-30 cm in height, in the electrical or barbwire fence to facilitate the movement of small mammals and reptiles through the site.

3.2.3 Avifauna

- Pre-construction monitoring has been done. A sufficient baseline database has been compiled which forms part of the long term avifauna monitoring as described in Section 6 of this LEMPR.
- Implement planning and design mitigation measures for protection of avifauna based on the outcome of the comprehensive bird monitoring programme as per the guidelines provided in Section 6 of this LEMPR.
- The length of any above-ground power lines shall be minimised and all new lines should be marked with bird flight diverters.

3.2.4 Aquatic Environment

In the Aquatic Walk-down Survey Statement (included as Appendix E(i), Dr Toni Belcher confirmed the following:

- Since small pan-like features occur within the area, it was recommended that the final proposed footprints of the BESS areas be ground-truthed to ensure that there are no aquatic features of significance within the final areas to be approved. The areas were ground-truthed on 10 April 2021. No pans were detected within either of the two approved laydown areas.

- Several open patches that are devoid of cover vegetation do occur in the area that appeared to have pan-like features however neither the vegetation, soils or the topography (flat rather than depressions and draining to the north rather than being endorheic) within these areas supports them being classified as pans. The open areas appear to be the result of past land use practice (overgrazing as well as use of sand along the Eskom lines to construct and shape the access road).

- There is some artificial aquatic habitat at a watering and feed point within the area that comprises a shallow dam and a constructed channel that drains overflow from the dam. Surrounding this area the patches of bare ground are more prolific as a result of increased grazing by livestock visiting the feeding and watering point.

- While ground-truthing the 'pan-like features' the wet areas along the water supply pipeline were also investigated and confirmed to be water leaks from a water supply pipeline that passes through the site from east to west, along the proposed access road to the substation, BESS, Gensets and Operation and Maintenance Buildings.

- The existence of the lower watercourse at the eastern extent of the proposed facility that has been mapped in the GIS layer downstream of the dam and adjacent to the Nonzwakazi township was also investigated and found to be no longer in existence. The dam although now breached impedes any flow in the watercourse at this point. A reasonable-sized dam basin still exists behind the breached wall that captures most of the runoff in the watercourse which, given its very small catchment does not generate significant runoff.

- In addition, the historic watercourse channel downstream of the dam comprises an area that

has been targeted for excavation and dumping of material. A berm has also been constructed along the boundary of the property, on the downstream side of the dam. No visible watercourse channel occurs this area although some seepage does still occur immediately downstream of the dam.

- An application for Water use Authorisation in terms of the National Water Act, 1998 is being made. The following is legal analysis and requirement is applicable (as included in Appendix E(ii):-

Section 21 Water Use	Applicability
(a) taking water from a water resource;	*The water use authorisation required for Section 21(a) water use activities should fall within the ambit of the General Authorisations for Section 21 (a) water use (Government Notice 538 of 2016).* In terms of water consumption, it is estimated that the facility requires approximately 4000 kl per annum of water would be required for the construction phase lasting 12-18 months and 700 kl per annum for the 20-year operations. The water for consumption is proposed to be obtained from groundwater where the total volume of water (cumulative when considering adjacent solar facilities proposed on the same property) would not exceed the 40 000 m3 limit for groundwater abstraction in the General Authorisations for Section 21 (a) water use (Government Notice 538 of 2016). Portion 1 (Remaining extent) of Farm De Aar 180 in which the proposed solar facility is located, lies within in Quaternary Catchment D62D. The property is approximately 2 564 ha in extent. The allowable groundwater abstraction in Quaternary D62D under the general authorisation is 45 m3/ha/a (approximately 115 380 m3/a).
(b) storage of water	*No water use authorisation required in terms of Section 21(b) for the project.* Water is pumped from boreholes and stored in Jo-Jo Tanks on site.
(c) impeding or diverting the flow of water in a watercourse;	*The Section 21 (c) water use activities associated with the project would fall within the General Authorisations for Section 21 (c) and (i) water uses.* The 75 MW solar energy facility and associated infrastructure lie within the catchment of minor tributaries in the Brak River a tributary in the lower Orange River System. The proposed facilities are being set back from any significant watercourses and where necessary the potential freshwater impacts mitigated to ensure that the activities would only pose a low risk of impacting on the watercourses and that the related Section 21 (c) and (i) water use activities would fall within the ambit of the General Authorisations for Section 21 (c) and (i) water use activities (Government Notice 509 of 2016).

(d) engaging in a stream flow reduction activity contemplated in section 36;	*No water use authorisation required. in terms of Section 21(d) for the project.* Activities listed in Section 36 (i.e. the use of land for afforestation or any other activity that has been declared by the Minister) are not applicable to the proposed Project.
(e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);	*No water use authorisation required in terms of Section 21(e) for the project.* The proposed Project does not include any of the listed controlled activities.
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;	*No water use authorisation required in terms of Section 21(f) for the project.* No wastewater or water containing waste will be discharged from the Project into the environment. Mitigation measures have been put in place to prevent any contaminated water originating at the site being discharged into a watercourse at capacities different to the current natural flow volumes.
(g) disposing of waste in a manner which may detrimentally impact on a water resource;	*The Section 21 (g) water use activities associated with the project would fall within the General Authorisations for Section 21 (g) water use.* All waste from the Project must be disposed of at a registered waste landfill and/or be recycled where applicable as per the conditions of the Environmental Authorisation. Conservancy or septic tanks and sewer lines are proposed to service ablution facilities on the sites that would potentially require authorisation as a Section 21(g) water use activity. Given the very small volumes of sewage envisaged to be generated on the site, this activity is expected to fall within the General Authorisations for Section 21(g) water use activities (Government Notice 665 of 2013).
(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;	*No water use authorisation required in terms of Section 21(h) for the project.* No water will be heated or used for the generation of electricity. The proposed PV project will make use of photovoltaic solar panels to generate power.
(i) altering the bed, banks, course or characteristics of a watercourse;	*The Section 21 (c) water use activities associated with the project would fall within the General Authorisations for Section 21 (c) and (i) water uses.* The 75 MW solar energy facility and associated infrastructure lie within the catchment of minor tributaries in the Brak River a tributary in the lower Orange River System. The proposed facilities are being set back from any significant watercourses and where necessary the potential freshwater impacts mitigated to ensure that the activities would only pose a low risk of impacting on the watercourses and that the related Section 21 (c) and (i) water use activities would fall within the ambit of the

	General Authorisations for Section 21 (c) and (i) water use activities (Government Notice 509 of 2016)
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and	*No water use authorisation required in terms of Section 21(j) for the project.* No underground water will be removed, discharged or disposed of.
(k) using water for recreational purposes.	*No water use authorisation required in terms of Section 21(k) for the project.* No recreational activities are proposed for the site by the developers. Therefore, this water use is not applicable.

3.2.5 Heritage

In the Heritage Statement Letter, included in Appendix D(h), Dr Jayson Orton confirmed the following:-

- The final layout for the three solar energy facilities forming part of the Mulilo Total Hydra Storage (MTHS) has been considered. The three facilities making up the MTHS are known as:
  - Badenhorst Solar PV2
  - Badenhorst Dam Solar PV3
  - Mulilo De Aar PV.
- The layout of the 75MW Badenhorst PV2 project area avoids all known heritage resources and there are no further heritage concerns.

General conditions are however applicable :

- Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule.
- If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. 38(4)c(ii).
- If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA.

3.2.6 Palaeontology

Dr John Almond confirmed the following:-

- The fossil heritage of the proposed solar facility developments are confined to the development footprint and are only anticipated during the construction phase.
- In view of the generally LOW palaeontological heritage sensitivity of the study area, as far as fossil heritage is concerned, the impact significance of the proposed solar PV facilities is LOW (with or without mitigation).

Note that the PIA Statement Letter attached in Appendix D(i) was compiled for the purpose of the 75MW Badenhorst PV2 BESS EA Amendment Application, but it also confirms the general palaeontological significance of the study area. Dr Almond also undertook the paleontological

studies for the Application for Environmental Authorisation in July 2013. In this study he concluded the following :-

Potential impacts of the proposed solar facility developments on fossil heritage are confined to the development footprint and are only anticipated during the construction phase. As far as fossil heritage is concerned, their impact significance is considered to be LOW for the following reasons:

- *The Karoo Supergroup bedrocks here are deeply weathered, locally calcretised and baked, and for the most part only sparsely fossiliferous;*
- *The development footprints for the proposed PV facilities are small and largely underlain by superficial deposits of low palaeontological sensitivity;*
- *Significant fossil material (e.g. fossil wood, vertebrate remains) at or near surface level is most likely only very sparsely distributed within the study area; and*
- *Extensive, deep bedrock excavations are not envisaged during the construction phase.*

3.2.7 Visual

- Rocky outcrops should be excluded from the development zone.
- The laydown area should preferably be located outside of direct view of the N10 and it is recommended that it be screened with shade cloth.
- Site offices and structures should be limited to single storey and they should be sited carefully to reduce visual intrusion. Colours should reflect hues of the surrounding vegetation and/or the ground. Roofs should be grey and non-reflective. Door and window frame colour should reference either the roof or wall colours.
- Minimising the visual impact of the BESS
  - The buildings should be painted a mid-grey, or grey-brown colour.
  - Fencing should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked on a monthly basis for the collection of litter caught on the fence.
  - Signage on the N10 should be moderated.
  - Lights at night have the potential to significantly increase the visual exposure of the proposed project; control lights at night to allow only local disturbance to the current semi-rural night sky.
  - Light spillage management should take place to ensure that security lighting at night is not visually intrusive. Lighting should be downward and inward facing and not include overhead security lighting options.

3.2.8 Socio-Economic: Local Training and Skills Development Plan

- A Local Training and Skills Development Plan was compiled and is included as Appendix D(j) and must be implemented by MTHS.
- This plan provides the following :-
  - A demographic overview and characteristics of the macro area
  - Legal requirement and policies in terms of skills development
  - Training and Skills Development opportunities in the De Aar macro area.
- The key issues affecting skills development in the energy sector include:
  - The energy sector is heavily dependent on the supply of highly qualified professionals and technicians and will continue to be dependent on them.
  - There are major transformation challenges from both a racial and gender perspective

in priority skills areas. The SETA-supported interventions should facilitate transformation in a planned and coordinated manner.

- The workforce is ageing and the number of professionals and technicians over 55 years of age points to the potential for significant changes over the next 5-10 years. The SETA should support the development of employees to fill the skills pipeline gap that may result from highly experienced professionals and technicians leaving the sector.
- The global thrust towards sustainable energy and renewables will lead to changes. There is potential for employment growth, and for growth in the expansion of new forms of energy production and the establishment and growth of small businesses, especially in the renewable energy subsector.
- With expected growth in the energy sector, the demand for high level professionals and technicians will increase, whilst the sector competes with other sectors nationally as well as globally for these skills. This implies the need to increase the skills supply to the sector.

- Current status of opportunities are as follows :-
  - Training capacity in De Aar is limited. This is largely linked to the size of the town/ local economy, and the existence of well-established facilities in the broader region.
  - Only one major institution offers accredited employment-orientated education and training, namely the Northern Cape Rural Technical and Vocational Education and Training (NCR-TVET) College. Only a limited number of courses are offered at the De Aar campus, and none of them directly relevant to the (renewable) energy or broader construction sectors.
  - Two institutions, Bakamosho and the Lead Academy, provide shorter training courses, but mainly aimed at improving life skills and other basic/ general skills. One driving school, De Aar Driving School, appears to be located in De Aar. Local security companies appear to make use of training facilities in Kimberley.
  - Globeleq and Solar Capital both operate SEFs in the De Aar area. Both companies offer engineering-focused bursary schemes. Solar Capital also provides a number of general training programmes open to local communities. No information could be sourced on construction phase training (<2016). Current training is essentially linked to ongoing OHS&E accreditation, with no service providers available in De Aar.
  - While Emthanjeni LM policy documents indicate that the renewable energy sector is anticipated to be a ‘game changer’ and anchoring activity in the local economy, no further enabling policies, programmes, structures, etc. seem to be in place. The Emthanjeni’s LED Manager indicated that training was largely limited to accredited local driver’s license and security guard training facilities.

The following relevant Training and Skills Development Courses have been identified :-

Training Courses	Target Groups	Applicability to Construction and Operational Phase
Health and Safety Legislation Training		
Introduction to OSH Act Provides employees with a basic knowledge of the responsibilities pertaining to the Occupational Health and Safety Act (OHS Act).	All employees, but especially management and supervisory staff Duration: 1 day Professional body: SAIOSH CPD Points: 2 Prerequisites: None	Applicable to all employees, and to both Construction and Operational Phase. Short duration (1 day) enables employees to undertake course before construction phase commences.
Advanced course on OSH Act Provides employees with in-depth knowledge and understanding of the OHS Act (procedures and regulations).	HS officers Duration: 2 day Professional body: SAIOSH CPD Points: 5 Prerequisites: None	Applicable to HS&E officers / managers associated with both Construction and Operational Phase.
Construction regulations Provides employees with an understanding of the Construction Regulations wherein, they will be able to apply legal referencing, understand the importance of compliance and be familiar with the processes and procedures regarding professional registration.	Employees involved on the construction related activities, including managers and supervisors. Duration: 1 day Professional body: SAIOSH CPD Points: 5 Prerequisites: None	Applicable to Site Managers and Supervisors involved in the Construction Phase.
GMR 2 (1) Supervisor of Machinery Provides employees with an overview of the key requirements of the OHS Act, pertaining to safe use of plant and machinery, and how to implement and manage these requirements.	HSE Managers, officers and practitioners, supervisors, and foremen. all employees involved use of plant, machinery, and equipment. Duration: 2 day Professional body: SAIOSH CPD Points: 5 Prerequisites: Communication and Mathematical Literacy at NQF Level 1	Applicable to HSE Managers, Site Managers and Supervisors (Foremen) involved in the Construction and Operational Phase.
Emergency Safety Training		
Basic Fire Awareness Provides learners with a basic understanding of common causes of fire in the workplace, consequences of fire and the basic legal requirements.	This course can be used as a fire induction programme for all employees Duration: 1 day Professional body: SAIOSH CPD Points: 2 Prerequisites: None	Applicable to all employees, and to both Construction and Operational Phase. Short duration (1 day) enables employees to undertake course before construction phase commences.
Basic Firefighting Ensures that learner will be capable of identifying, containing, preventing, and extinguishing different types of fires by operating basic firefighting equipment.	All employees responsible for workplace firefighting and appointed workplace firefighters, or persons who want to gain greater knowledge about workplace firefighting and basic fire prevention. It is useful to have a fire marshal complete this programme, as they act as the backup for the appointed workplace firefighter. Duration: 1 day	Applicable to employees involved in Fire Fighting, including HSE Manager, Site Manager and Fire Officer. Training associated with Construction and Operational Phase.

First Aid Level 1 First Aid level 1 is the minimum required qualification for all workplaces in South Africa (OSHS Act). The course equips candidates with the basic principles of assessing an emergency situation, contacting the emergency services as quickly as possible and while awaiting their arrival, candidates will be able to perform basic skills required to sustain life.	Aimed at companies that need to ensure employees are equipped to deal with emergency situations that requires first aid, and to ensure legal compliance. Duration: 2 days SAQA ID: 119567 Professional body: SAIOSH NFQ Level: 1 CPD Points: 5 Prerequisites: None	Applicable to HSE Manager, First Aid Officer, Site Managers and Supervisors (Foremen) involved in the Construction and Operational Phase.
First Aid Level 2 Enables learners to provide primary emergency care (first aid) in response to an occupational risk induced or any health emergency in their specific workplaces.	Apples to companies with a higher risk profile and provides employees with a more in-depth knowledge of various injuries and emergency conditions. Duration: 2 days Professional body: SAIOSH CPD Points: 5 Prerequisites: First Aid Level 1 Certificate	Applicable to First Aid Officer involved in the Construction and Operational Phase.
First Aid Level 3 Enables the first responder to react to emergencies at an advanced first aid level, until the arrival of more professional emergency personnel.	Applies to companies that want to ensure employees are equipped to deal with any emergency situation that requires advanced first aid and to ensure legal compliance. Duration: 4 days Professional body: SAIOSH CPD Points: 5 Prerequisites: First Aid Level 2 Certificate	Applicable to First Aid Officer involved in the Construction and Operational Phase.
Emergency Evacuation Procedures Enables learners to distinguish between an emergency and an incident as well as understanding the different types of emergencies that may take place in the workplace and the required procedures to be implemented.	Employees responsible for workplace evacuation, emergency preparedness and assisting emergency teams in emergency planning. Duration: 2 days SAQA ID: 259597 Professional body: SAIOSH NFQ Level: 2 CPD Points: 5 Prerequisites: None	Applicable to HSE and Site Manager involved in the Construction and Operational Phase.
Fire Marshall Enables learner to identify, contain, prevent and extinguish different types of fires by operating basic firefighting equipment.	Employees responsible for workplace firefighting and appointed workplace firefighters. It is useful to have a fire marshal complete this programme, as they act as the backup for the appointed workplace. Duration: 2 days SAQA ID: 252250 Professional body: SAIOSH NFQ Level: 1 CPD Points: 5 Prerequisites: None	Applicable to HSE Manager, Site Manager and Fire Officer involved in the Construction and Operational Phase.

Industrial and Commercial Driving Safety Training		
Operate a Heavy Vehicle Provides employees with comprehensive practical and theoretical programme on road safety and defensive driving for rigid and /or articulated /combination vehicles.	Aimed at Code C, C1 and EC and EC1 drivers that operate a heavy rigid, an articulated or vehicle. Duration: 3 days SAQA ID: 123254/123253 NFQ Level: 3/4 Prerequisites: Communication and Mathematical Literacy at ABET Level 3	Applicable to employees involved in operation of Heavy Vehicles. Likely to be more relevant to Construction Phase. However, maintenance activities during the Operational Phase may also require operation of Heavy Vehicles.
Operate a Light Vehicle Provides employees with a comprehensive practical and theoretical programme on road safety and defensive driving for light motor vehicles.	Aimed at Code 8EB or B drivers Duration: 2 days SAQA ID: 123257 NFQ Level: 2 Prerequisites: Proof of 60 driving hours, Communication and Mathematical Literacy at ABET Level 2 and valid Code 8EB or B license.	Applicable to employees involved in operation of Light Vehicles during Construction and Operational Phase.
Transport Dangerous Goods by Road Dangerous Goods Training required in terms of Chapter 8 of the Road Traffic Act 1996. Drivers trained in conveying dangerous goods in accordance with legal, safety, manufacturer, and other relevant requirements, and to handle incidents safely when they occur.	All drivers who need to renew or apply for their professional driving permits (PrDP) for transportation of dangerous goods. All drivers that convey dangerous goods by road. Controllers that oversee the transportation of dangerous goods. Duration: 2 days SAQA ID: 123259 NFQ Level: 3 Prerequisites: NQF Level 2 Mathematical Literacy and Communication competence. Valid driver's licence and valid PrDp and be aged 25+.	Applicable to employees involved in transport of Dangerous Goods. Likely to be more relevant to Construction Phase. However, maintenance activities during the Operational Phase may also require transport of Dangerous Goods.
Industrial and Commercial Compliance Training		
Representative Skills Programme Enables employees to apply safety, health, and environmental protection procedures, perform inspections and describe the functions of the workplace health and safety representative. The course also enables employees to perform an investigation into workplace safety, health, and environmental incidents.	HSE Managers and representatives Duration: 5 days Professional body: SAIOSH Prerequisites: Communication and Mathematical Literacy at NQF Level 3.	Applicable to HSE Manager involved in the Construction and Operational Phase.
Hazard Identification and Risk Assessment (HIRA) Enables employees to prepare and conduct a risk assessment as well as, initiate remedial actions for hazards identified and risks assessed.	Management and supervisors, HSE representatives and other HSE practitioners, any person who is expected to carry out formal hazard identification and risk assessments. Duration: 2 days NFQ Level: 3 Prerequisites: Communication and Mathematical Literacy at NQF Level 2.	Applicable to HSE Manager involved in the Construction and Operational Phase.

Warehouse Operations and Logistics Training		
Warehouse Operations Skills Course Employees provided with practical and theoretical knowledge of receipt, dispatch and returns of freight procedures.	Aimed at supervisors or team leaders that operate within various warehousing environments. Duration: 2 days Prerequisites: Communication and Mathematical Literacy at NQF Level ABET 2.	Applicable to Stores Manager / Administrative Manager involved in the Construction and Operational Phase.
Receive and Dispatching Freight and Handling Freight Returns Employees provided with practical and theoretical knowledge of receipt, dispatch and returns of freight procedures.	Aimed at employees receiving and dispatching, and handling freight returns within the warehousing or logistic chain. Duration: 2 days SAQA ID: 8024 NFQ Level: 3 Prerequisites: NQF 1 or General Education and Training Certificate; Operating Computer Systems "Allocation of Freight for packaging and grouping"; "Occupational Health, Safety and general Housekeeping".	Applicable to Stores Manager and employees involved in procurement during the Construction and Operational Phase.
Counting stock for stock taking Provides training to employees involved in stocktaking.	Aimed at employees working with stock within the warehousing or logistics chain. Duration: 2 days NFQ Level: 2 Prerequisites: Numeracy and Literacy at NQF Level 1 or equivalent	Applicable to Stores Manager and employees involved in procurement during the Construction and Operational Phase.

3.2.9 Floodlines

- A Floodline Assessment was undertaken by Civilconsult Consulting Engineers and is included in Appendix D(a). The western boundary of the 75MW Badenhorst Solar PV2 is affected by the 1:50 and 1:100 year floodlines.
- The specifications and mitigation measurement, prepared by Civilconsult and provided in the Stormwater Management Plan in Appendix D(b) and as described in Paragraph 3.2.12 must be implemented.

3.2.10 Traffic Management Plan

- The Traffic Management Plan (TMP) compiled by JG Africa is included as Appendix D(k)(i) and must be implemented.
- The objective of the TMP is to ensure that the trips generated by the construction and operational activities associated with the facility are mitigated as far as possible in order to:

  - reduce the traffic impact on the surrounding road network;
  - reduce potential conflicts that may results from the development traffic and the general traffic/public; and
  - to identify potential routes for vehicles travelling to the site, particularly heavy and abnormal load vehicles.
- This TMP has been prepared to enable the identification and implementation of all legal and best practice requirements in respect of the management of traffic associated with the construction and operation of the facility.
- The following assumptions and limitations apply:
  - This TMP is based on the project information provided by the Client.
  - Maximum vertical height clearances along the haulage route are at least 5.2m to be able to accommodate abnormal loads.
  - All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
  - Material for the construction will be sourced locally as far as possible.

- The following key requirement issues were identified :-

  - During construction, the Plan needs to be reviewed every four months or immediately after an incident, when corrective measures will be incorporated into the Plan.
  - Prior to the commencement of the operational phase, the TMP needs to be updated to include the operational traffic requirements.
  - The TMP needs to be reviewed annually or immediately after an incident, when corrective measures have to be incorporated into the TMP.
  - Traffic during the operational phase will be low as trips will only be for occasional maintenance requirements, staff trips (assumed at 30 permanent staff).
  - For abnormal load vehicles, it is recommended to undertake a “dry-run” with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that the delivery will occur without disruptions.
  - A 12m wide access road servitude will be constructed off the N10 Highway and traverse a Transnet railway line before traversing roughly 6km over the leased Farm De Aar 1/180.
  - The potential main access road to the facility will be located off the N10. Two access road options were proposed and both options will connect to the N10 and traverse the railway line and a watercourse. Option 1 would require the construction of a new road and railway, whereas Option 2 involves the upgrade of the existing gravel road.
  - Proof of submission of the application for wayleave approval is attached as Appendix D(k)(iii).

3.2.11 Transport Management Plan

- A Transportation Plan was compiled and is included as Appendix D(k)(ii)for the transport of panel components, main assemble cranes and other large pieces of equipment.
- The potential transport related impacts for the construction and operation phases for the proposed Mulilo Total Hydra Storage Project were assessed.
- The construction phase traffic, although significant, will be temporary and impacts are considered to have a medium significance without mitigation measures and low with mitigation measures.
- During operation, it is expected that staff trips and trips for maintenance requirements to the facility will occur. Approximately 30 full-time workers will be stationed on site.
- The number of water delivery vehicles transporting water could be reduced by providing boreholes and/or water storage tanks on site and staggering deliveries outside peak hours.

However, it is estimated that water will only be delivered to site a maximum of four times a year.

- The traffic generated during this phase will be accommodated by the surrounding road network.
- The potential mitigation measures mentioned in the construction phase are:
    - Dust suppression
    - Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
    - The use of mobile batch plants and quarries near the site would decrease the impact on the surrounding road network.
    - Staff and general trips should occur outside of peak traffic periods.
- If required, any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.
- The construction and decommissioning phases of a development are the significant traffic generators and therefore noise and dust pollution will be higher during these phases. The duration of the phases is short term, i.e. the impact of the traffic on the surrounding road network is temporary and the facility, when operational, will not add any significant traffic to the surrounding road network.
- The development is supported from a transport perspective provided that the recommendations and mitigations contained in this report are adhered to.
- The impacts associated with the Mulilo Total Hydra Storage Project are acceptable with the implementation of the recommended mitigation measures.

Additional recommendations:-

- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled.
- Internal roads should be designed to have minimal impact on the environment.
- Where roads intersect natural, defined drainage lines, suitably sized pipe culverts or drive through causeways should be installed or constructed.
- The gravel roads should have the following: a crowned driving surface, a shoulder area that slopes directly away from the edge of the driving surface, and a ditch.
- Where the roads intersect drainage lines a suitably sized culvert should be used. It is important that ditches and culverts be kept clear from obstructions. The stormwater impact on the existing N10 road and railway line (Alternative 2) will need to be investigated to ensure they are not impacted in any way and that existing associated culverts and channels still meet accepted design criteria.
- A buffer zone of 60m along the N10 is required by SANRAL, in order to screen the PV facility.

3.2.12 Stormwater Management Plan

- A Stormwater Management Report was compiled by Civilconsult Consulting Engineers and is included in Appendix D(b).
- The following key aspects must be adhered to at all times in order to ensure the proposed storm water infrastructure functions as intended and to mitigate any possible chance for impacting the environment in a negative way:-

- Inspect and monitor the performance and integrity of all proposed infrastructure on an annual basis.
- Include an Erosion Monitoring Plan *(refer to Appendix D(c))*. The plan should ensure that all erosion effects are identified and that the rehabilitation of these erosion effects are implemented as soon as possible. Erosion which might have occurred as a result of a major storm event should be detected and rehabilitated as soon as practically possible.
- Introduce a monitoring system for spills and leaks such that they are detected and remediated as soon as practically possible.
- The Stormwater Management Plan should be reviewed and updated regularly to improve its practicality, cost-effectiveness and efficacy.
- Frequent inspections are required during the construction phases until the proposed stormwater infrastructure is installed and operational as per the design standards.
- Alerts should be set up for the following :-
    - Automatic alert systems for the wastewater conservancy tank (e.g. a float driven switch alert system)
    - Brief, annual refresher training that should not take more than half an hour for each staff member must be supplied.
    - Well placed signs that remind staff members of reporting of incident / issues, as soon as possible and reduce the likelihood that forgetfulness or confusion will prevent reporting.
- A Typical Storm Water, Waste Water and Erosion Management Plan is included in the Stormwater Management Report. These general requirements must be considered at all times.

3.2.13 Agricultural Land

- A simplified and generic phased construction approach and related mitigations must be adopted.
- Allow normal agricultural activities to continue in unaffected areas.

3.2.14 Eskom Requirement

Eskom requirements for work in or near Eskom servitudes and infrastructure:

- Eskom's rights and services must be acknowledged and respected at all times.
- Eskom shall at all times retain unobstructed access to and egress from its servitudes.
- Any cost incurred by Eskom as a result of non-compliance to any relevant environmental legislation will be charged to the developer.
- If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the developer's activities or because of the presence of his equipment or installation within the servitude restriction area, the developer shall pay such costs to Eskom on demand.
- The use of explosives of any type within 500 metres of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the developer must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard.

- Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's satisfaction.
- Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the developer, his/her agent, contractors, Employees, successors in title, and assignees. The developer indemnifies Eskom against loss, claims or damages including claims pertaining to consequential damages by third parties and whether as a result of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the developer's equipment.
- No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the developer must give at least seven working days' notice prior to the commencement of work. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued by the relevant Eskom Manager. Note: Where an electrical outage is required, at least fourteen work days are required to arrange it.
- Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with.
- Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom.
- The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by *Regulation 15* of the *Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).*
- Equipment shall be regarded electrically live and therefore dangerous at all times.
- In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), as an additional safety precaution, Eskom will not approve the erection of houses, or structures occupied or frequented by human beings, under the power lines or within the servitude restriction area.
- Eskom may stipulate any additional requirements to highlight any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant.
- It is required of the developer to familiarise himself with all safety hazards related to Electrical plant.
- Any third party servitudes encroaching on Eskom servitudes shall be registered against Eskom's title deed at the developer's own cost. If such a servitude is brought into being, its existence should be endorsed on the Eskom servitude deed concerned, while the third party's servitude deed must also include the rights of the affected Eskom servitude.

3.2.15 Battery Energy Storage System (BESS)

- iSHEcon compiled a ***BESS Safety, Health and Environmental Risk Assessment Report*** (attached as Appendix D(m)(i) for the purpose of the EA Amendment to include BESS into the project components.
  This assessment of risk comprised the following:
  - Identification of the likely hazards and hazardous events related to the operation of the installation using a checklist approach.
  - Estimation of the likelihood/probability of these hazardous events occurring

- Estimation of the consequences of these hazardous events.
- Estimation of the risk and comparison against certain acceptability criteria.

The requirements of this report had been integrated in Paragraphs 4.10; 5.2 and 8.1 of this report and must be implemented.

- An ***extract on the risk assessment from the Technical Engineering Report-Battery Storage Systems*** is provided in Appendix D(m)(ii).

  Risk associated with the following were assessed :-

  Environmental Health & Safety Risk
  - Explosion hazards, caused by a rapid expansion of gases
  - Fire hazards, arising from combustible materials used in the storage system
  - Thermal hazards, due to the thermal properties of a system or its components
  - Thermal runaway hazard, causing propagation of increasing temperatures, pressures, and fire towards neighbouring cells.
  - Chemical hazards, caused by (unforeseen) contact between a person and toxic, acidic, corrosive components leaking from the BESS system.

  Risk Assessment
  - Failure of BESS (electrical, mechanical, thermal and human error)
  - Risk of fire, explosion or release of toxic gas
  - Transport and Disposal of Hazardous Materials
  - Leaking or spillage of electrolytes or other liquids
  - Additional hazards:
  - Additional hazards for large-scale BESS can be categorised as follows
    - electrical, occurring when there is direct contact between a person and the system
    - mechanical, occurring after a physical collision
    - poisoning or exposure to hazardous materials

  Mitigation

  Safeguards incorporated into BESS (reduce the likelihood and severity of events before a battery fire escalates. Mitigation measures must be implemented and include the following :-

  - Adequate cooling and management of temperature excursions should be primary considerations in the design and implementation of a Li-ion battery.
  - Consideration of off gases, their routing and management, should also be a primary concern.
  - In most cases, the temperature of Li-ion batteries should not be higher than 70°C to prevent thermal runaway, unless explicitly approved by the BESS manufacturer.
  - The temperature of Li-ion batteries should not go below 0°C (unless manufacturer specified) to prevent Li- plating, which may result in internal shorts. As some Li-ion chemistries are more sensitive than others to cold temperatures, manufacturer specifications should be checked for specific limitations. For cold discharge tests reference is made to UL 1642, or IEC 62660-2.
  - Appropriate ventilation should be incorporated to manage potential off-gassing or evaporated electrolyte. In the case of larger batteries, monitoring of the lower explosive/flammable limit (LEL) of the air may be necessary.
  - Whenever possible, detection or monitoring equipment should be considered for off-gases which may also be incorporated into emergency shut-down or extinguishing capability.

- For abuse testing of Li-ion batteries, reference is made to IEC 62660-02. For ventilation of Li-ion batteries, reference is made to IEC 62485-2.
- Though thermal stability and volatility may vary, all lithium ion batteries are flammable when exposed to fire.
- For safety tests regarding the (battery) management systems of Li-ion battery systems reference is made to IEC 62619.
- Thermal separation or insulation should permit the burning of a single cell to conclude without causing additional cells to fail, even if extinguishers fail to actuate, mitigating the risk that a single cell failure triggers automated extinguisher. Sufficient cascading protection should be implemented as one of the most important passive design features of a BESS.
- The safety risk of large scale and cascading thermal runaway should be managed with appropriate containment, thermal management systems, extinguishing and isolation procedures. Containment may include active cooling, metal or ceramic plates, or heat absorbing materials.
- A Li-ion battery fire has the potential to evolve through all known fire classes. All of the precautions required at the local level should be considered during fire extinguisher and containment selection, including but not limited to:
  - cooling requirement
  - gases released within enclosed spaces
  - chemical reactions between extinguishers and burning materials
  - cascading protections in the system to limit fire propagation
  - external fire threats
  - incipient fire versus full system fire extinguishers
  - chemical contamination and collateral damage from non “clean agent” extinguishers
  - hazardous materials and clean-up
  - Risks to building occupants and first responders, including gas generation from batteries after fires, as batteries may continue to evolve CO and H2 long after the fire has been extinguished.
- Presently, there is no adequate extinguisher solution that addresses all fore-mentioned issues simultaneously. Therefore, fire protection design may include multiple extinguishers, or a single extinguisher that is admittedly a compromise. A common example of such a compromise that may be applied is using large volumes of water to ensure cooling, provided that water does not create further hazardous gas conditions, e.g. in a confined, occupied space. Precautions should be taken to prevent electrocution by water.
- Care should be taken to provide adequate cooling and monitor for gas generation during and after fire ground operations. SOC and SOH information should be available on the physical outside of the Li-ion system, for use by fire departments and other helping hands. Reference is made to UL 9540 for design and implementation of system level BESS safety measures.

- ***2020 ISS BESS Fire Standards and Risk Engineering Standards*** are included as Appendix D(m)(iii). It confirms the following standards are relevant to the design and development of BESS and must be implemented :
  - NFPA 850 Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations.
  - NFPA 855 Standard for the Installation of Energy Storage Systems
  - IFC 1206/2018 Standard for Electrical Energy Storage Systems
  - ANSI/CAN/UL Standard for Test Methof for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
  - ISO 15779:2011 Condensed Aerosol Fire Extinguishing Systems

- **NARADA Specifications** are included in Appendix D(m)(iv).
  Narada, established in 1994 in Hangzhou, China, is one of the leading battery manufacturers and global battery suppliers in the world. NARADA products, systems and specifications will be used for the MTHS project of which the relevant documents are the following:
    - Containerised BESS Operation and Maintenance Manual
    - Lithium Iron Phosphate Battery Operation & Maintenance Manual
    - Material Safety Data Sheet
    - Certification for the NESP High Rate Lithium Battery

3.2.16 Emergency Response and Fire Management Plan

The objectives of the MTHS Emergency Response and Fire Management Plan are the following:-

- To assist contractor personnel to prepare for and respond quickly and safely to emergency incidents, and to establish a state of readiness which will enable prompt and effective responses to possible events.
- To control or limit any effect that an emergency or potential emergency may have on site or on neighbouring areas.
- To facilitate emergency responses and to provide such assistance on the site as is appropriate to the occasion.
- To ensure communication of all vital information as soon as possible.
- To facilitate the reorganisation and reconstruction activities so that normal operations can be resumed.
- To provide for training so that a high level of preparedness can be continually maintained.

This plan outlines response actions for potential incidents of any size. It details response procedures that will minimise potential health and safety hazards, environmental damage, and clean-up efforts. The plan has been prepared to ensure quick access to all the information required in responding to an emergency event. The plan will enable an effective, comprehensive response to prevent injury or damage to the construction personnel, public, and environment during the project. Contractors are expected to comply with all procedures described in this document.

A Method Statement should be prepared at the commencement of the construction phase detailing how this plan is to be implemented as well as details of relevant responsible parties for the implementation. The method statement must include the following:

- Identification of areas where accidents and emergency situations may occur;
- Communities and individuals that may be impacted;
- Response procedure;
- Provisions of equipment and resources;
- Designation of responsibilities;
- Communication; and
- Periodic training to ensure effective response to potentially affected communities.

Implementation and Management

The Contractor's Safety, Health and Environment (SHE) Representative, employed by the Contractor or Project Company, is responsible for managing the day-to-day on-site implementation of this Plan, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the SHE must act as liaison and advisor on all environmental and related issues.

CHAPTER 4: CONSTRUCTION PHASE

The Construction EMPR (CEMPR) aims to address mitigation measures pertaining to the construction phase as identified during the course of the EIA. This section includes both General Specifications as well as Draft Specification Data, addressing general construction issues and issues that are not addressed by the General Specifications, respectively. It should be noted that the Draft Specification Data should be revised as required post authorisation to ensure that all relevant conditions of the EA have been addressed.

4.1 Construction EMPR General Specifications

The complete General Specifications have been included in **Appendix C** and include the following sections:

- Scope
- Normative References
  - Supporting Specifications
- Definitions
- Requirements
  - Material
  - Material handling, use and storage
  - Hazardous substances
  - Shutter oil and curing compound
  - Bitumen
  - Plant
  - Ablution facilities
  - Solid waste management
  - Contaminated water
  - Site structures
  - Noise control
  - Lights
  - Fuel (petrol and diesel) and oil
  - Workshop, equipment maintenance and storage
  - Dust
  - Methods and procedures
  - Environmental awareness training
  - Construction personnel information posters
  - Site clearance
  - Site division
  - Site demarcation
  - "No go" areas
  - Protection of natural features
  - Protection of flora and fauna
  - Protection of archaeological and paleontological remains
  - Access routes/ haul roads
  - Cement and concrete batching
  - Earthworks
  - Pumping
  - Bitumen
  - Fire control
  - Emergency procedures
  - Community relations
  - Erosion and sedimentation control
  - Aesthetics
  - Recreation
  - Access to site
  - Crane operations
  - Trenching
  - Demolition
  - Drilling and jack hammering
  - Stockpiling
  - Site closure and rehabilitation
  - Temporary re-vegetation of the areas disturbed by construction
  - Temporary site closure
- Compliance with requirements and penalties
  - Compliance
  - Penalties
  - Removal from site and suspension of Works
- Measurement and Payment
  - Basic principles
    - General
    - All requirements of the environmental management specification
    - Work "required by the Specification Data"
  - Billed items
    - Method Statements: Additional work
    - All requirements of the environmental management specification

4.2 Project Specifications

The following section provides the Specification Data which, along with the General Specifications, will be included in all contract documentation associated with the proposed project and will accordingly be binding on the Contractor.

Scope: The general principles contained within this Specification Data: Environmental Management (SDEMA) shall apply to all construction related activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

Interpretations: This Specification contains clauses specifically applicable and related to the environmental requirements for the PV2 solar energy facility on Badenhorst Dam Farm, near De Aar, in the Northern Cape.

Where any discrepancy or difference occurs between this SDEMA and the Specification: Environmental Management (Comprehensive), the provision of this Specification shall prevail.

Definitions:
For the purposes of this Specification the following definitions shall be added:

- Contractor:
  The Contractor must ensure that all of its sub-contractors, Employees, etc., are fully aware of the environmental issues detailed in this LEMPR. The Contractor shall liaise closely with the SE, Environmental Officer (EO) and the Environmental Control Officer (ECO) and must ensure that the works on site are conducted in an environmentally sensitive manner and fully in accordance with the requirements of the LEMPR, at all times.

- Developer:
  The developer refers to the holder of the Environmental Authorisation who will be responsible for the following tasks, but not limited to:
  - Ensure that the requirements as set out in this LEMPR are adhered to and implemented;
  - Allocate the responsibilities assigned to the ECO to an independent suitably qualified individual prior to the start of construction activities on site; and
  - Provide all principal contractors working on the project with a copy of this CEMPR as part of tender contract documentation to allow the contractors to cost for its requirements within their respective construction contracts.

- Environmental Control Officer (ECO):
  The Developer shall appoint a suitably qualified ECO to monitor the Contractor's compliance in terms of this LEMPR and the conditions contained in the EA. The designation is reserved for a suitably qualified (National Diploma / Degree in Natural Science or an equivalent qualification), independent, environmental manager, with adequate environmental knowledge to understand and implement the LEMPR. The duties of the ECO during construction phase will include but are not limited to:
  i) Liaison with the Client, Project Manager or Engineer and DFFE;

ii) Monitoring of all of the Contractor's activities for compliance with the various environmental requirements contained in the construction Specification;
iii) Monitoring of compliance with the EA related to the construction phase as issued by DFFE as well as other relevant environmental legislation;
iv) Reviewing of the Contractor's environmental Method Statements;
v) Ensuring that the requisite remedial action is implemented in the event of non-compliance;
vi) Ensuring the proactive and effective implementation and management of environmental protection measures;
vii) Ensuring that a register of public complaints is maintained by the Contractor and that any and all public comments or issues are appropriately reported and addressed;
viii) Routine recording and reporting of environmental activities on a weekly and monthly basis;
ix) Recording and reporting of environmental incidents; and
x) Oversee and monitor compliance with and implementation of the construction phase EMPR, Operational Phase EMPR and Rehabilitation Plan, including compliance with the relevant conditions contained in the EA.

- Responsible persons:
  Effective environmental management during the construction phase will be dependent on a number of project personnel. The purpose of this section is to define roles for personnel and to detail their respective responsibilities in the execution of the CEMPR.

- Site Engineer (SE):
  The SE is responsible for ensuring that the contract is carried out to completion on time, in budget and that each Contractor fulfils his obligations in terms of conditions contained in the EA.

- Working area:
  The land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the developer in connection with the Works. The Working Area shall include the site office, construction camp, stockpiles, batching areas, the construction area, all access routes and any additional areas to which the Engineer permits access. The construction footprint must be kept to a minimum.

4.3 Plans, policies, programmes and permits required for the construction phase

During the construction phase specific plans, policies, programmes and permits need to be compiled and obtained to be included in the LEMPR. Table 5 below provides a quick reference list of these requirements.

Table 2: Plans and permits required for the construction phase

Planning phase	Plans, policies, programmes and permits required	Status
Flora	Alien Invasive Management Plan	To be implemented during construction phase (refer to Appendix D(f)(iii)
Flora	Permit for removal Protected Plant Species	The permit must be obtained before site clearance can commence *Refer to Appendix D(f)(vi)
Flora	Re-vegetation and habitat rehabilitation plan	To be implemented during construction phase (refer to Appendix D(f)(iv)
Avifauna	Long term avifauna monitoring programme	Continuous Details provided in section 6 of this LEMPR

4.4 Structure of the CEMPR

Each activity identified in the EIA process comprises various aspects, which have associated impacts. These, along with the mitigation measures and performance indicators, are outlined in the table below.

Five main categories have been identified and tabled for the CEMPR namely:

- General
- Establishment of the construction camp
- Clearing of the site
- Construction of the PV panels and associated infrastructures
- Removal of the construction related debris, materials or equipment

The information is summarised in Table 1-5 below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- Activity: component/ activity of the project for which the impact has been identified.
- Aspect: the aspect of the above activity which will be impacted.
- Impact: the environmental impact identified and to be mitigated.
- Mitigation measure: measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
    - Objective: desired outcome of mitigation measure.

- Mechanism: method of achieving the objective.

- Performance indicators: outcomes that will indicate achievement of objective/s.
- Responsibility: party or parties identified for implementation of mitigation measure/s.
- Resources: available resources to aid implementation of mitigation.
- Schedule: timeframe in which identified impact and mitigation measure is anticipated to occur.
- Verification: party or parties identified as responsible for review and assessment of final outcome.

4.5 CEMPR: General

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	**Communication**	Inability to Communicate the environmental obligations effectively to responsible parties can result in unnecessary environmental degradation. It can also compromise the health and safety of employees.	**Objective:** To ensure that the construction activities do not result in avoidable impacts on the environment by anticipating and managing the impacts. **Mechanism:** 1) The contact details of the key construction team must be available to all relevant parties. 2) All site instructions pertaining to environmental matters issued by the Engineer are to be copied to the ECO. 3) All sub-contractors, employees, suppliers or agents etc. must be fully aware of the environmental management requirements detailed in this CEMPR. 4) The Engineer and ECO must be informed immediately should environmental issues arise. 5) A copy of the EIR, CEMPR and EA must be present at the construction site for easy reference to specialist recommendations.	No avoidable environmental impacts occurring due to miscommunication. The ECO is aware of decisions taken by the engineer and contractors.	ECO, Engineer and Contractor.	During the construction phase (from site establishment to contract completion).	ECO and developer
2.	**Training of workers**	Without proper training the health and safety of workers will be at risk and preventable environmental impacts could occur.	**Objective:** To provide health and safety training to construction workers to ensure a safe working construction site and to ensure that each employee is aware of the environmental impacts that could occur. **Mechanism:** 1) Temporary and permanent construction workers must undergo environmental awareness training and health and safety training as part of the induction training.	All employees adhere to the mitigation measures provided in this document. All operators of mechanical equipment are trained properly by the contractor. All workers have	Contractor and ECO The Contractor shall supply the ECO with a monthly report Indicating the number of employees that will be present on	During the construction phase (from site establishment to contract completion).	DFFE and the developer

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			2) The following aspects need to be covered as a minimum: • The prevention of accidental spillage of hazardous chemicals and oil; • Disposal of waste; • The No-Go areas; • Litter control; • Identification of archaeological artefacts and whom to report it to; • The use of firefighting equipment and Personal Protective Equipment (PPE); and • HIV/AIDS awareness. 3) Environmental posters and/ or translators can be used for training purposes. 4) Staff operating equipment (such as loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks. 5) Follow-up training courses must be attended throughout the construction period as deemed necessary by the ECO. 6) All new employees that spend more than one day a week on site are to attend the environmental education program within one week of commencement of work.	attended Environmental awareness training and health and safety training.	site during the following month.		
3.	**Protection of fauna, flora and avifauna**	Constructing a PV facility may have impacts on- the fauna, flora and avifauna.	**Objective:** To prevent unnecessary disturbance to natural vegetation. **Mechanism:** 1) A rehabilitation plan for the site will be compiled with the aid of a rehabilitation specialist and adhered to. 2) Unnecessary impacts on surrounding natural	No animals are injured. No employees enter the no-go areas. No alien vegetation establishment.	ECO, Contractor	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			vegetation must be avoided. The construction impacts must be contained to the footprint of the solar array and other associated infrastructure as well as to the footprint of the tower structures and/or the servitude of the power line. 3) Areas outside the construction footprint should be fenced and access to these areas should be limited as much as possible. 4) Existing access roads must be used, where possible. 5) Service roads in the servitude must be properly maintained to avoid erosion impacts. 6) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum. 7) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. 8) Any alien plants within the control zone of the company must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used. 9) An on-going alien invasive monitoring programme will be implemented to detect and quantify any aliens that may become established and provide information for the management and monitoring of aliens. 10) Disturbance of indigenous vegetation outside of the footprint of construction must be kept to a minimum. 11) Where disturbance is unavoidable, disturbed	Invasive alien vegetation monitoring programme implemented.			

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			areas should be rehabilitated as quickly as possible. 12) Minimising the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds. 13) Comply with the bird monitoring scheme in Section 6 of this LEMPR.				
4.	**Stormwater runoff, erosion, and pollution of surface water and groundwater resources.**	Contamination of stormwater runoff can impact on the surface and groundwater resources The mismanagement of stormwater can furthermore result in erosion.	**Objective:** Prevent stormwater from eroding the land and becoming contaminated. **Mechanism:** 1) Straw barriers should be installed in drainage paths to act as a check dam, i.e. to reduce velocity, and as a sediment trap during construction. Suspended solids carried by overland flow will be intercepted. These are erosion barriers placed at intervals of 25-50 m apart in the drainage paths which will intercept suspended solids from entering the natural drainage paths. 2) Packed stone (also known as rip-rap) must be placed as liners for channel spines. These comprise packed stones with an average diameter of 100 mm, packed in the channels as lining material to control flow velocities and hence erosion. 3) Earth cut-off channels at boundaries of the facility. These will assist in directing flow away from the site and reduce the possibility of flooding from runoff origination from outside the site. 4) Provide erosion protection at channel outfalls and positions of high flow concentration. These comprise packed stones with an	Stormwater not Contaminated by construction activities. Stormwater control measures are Effective at regulating runoff from the site and erosion channels do not develop. Freshwater ecosystems are not unduly disturbed by construction activities within the drainage channels.	ECO and contractor ECO to inspect soils for erosion at regular intervals.	After site Clearing has taken place up to the end of the construction phase.	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			average diameter of 200mm, packed in the drainage path to control flow velocities and hence erosion. 5) Comply with regulations as set out in the storm water management plan to be implemented during construction. 6) A buffer of 30m should be maintained adjacent to the identified streams for the proposed PV footprint area as well as the substations. 7) Construction activities for the proposed infrastructure that will need to take place within the river channels and riparian zone (i.e. linear development components including roads, transmission lines and water pipeline) should transect the streams at right angles and be limited as far as possible to ensure minimum disturbance of this area. 8) Disturbed areas within the riparian zones and stream beds should be rehabilitated as soon as possible after construction has been completed and revegetated with suitable indigenous vegetation according to the approved rehabilitation plan. Where possible previously disturbed areas, such as existing roads or transmission line routes, should be utilised. 9) Construction should preferably take place during the low flow period to minimise the risk of erosion and contaminated runoff from construction site into freshwater systems. 10) Contaminated runoff from the construction site should be prevented from entering the streams. 11) Invasive alien plant growth within the disturbed areas should be monitored and				

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			managed. 12) Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines. 13) Construction activities for the proposed infrastructure that will need to take place within the river channels and riparian zone (i.e. linear development components – roads, transmission lines and water pipeline) should transect the streams at right angles and be limited as far as possible to ensure minimum disturbance of this area. 14) Minimise duration and extent of construction activities in the river – construction should also preferably take place in the low flow season. 15) Clearing of debris, sediment and hard rubble associated with the construction activities should be undertaken post construction to ensure that flow within the drainage channels are not impeded or diverted. 16) Rehabilitate disturbed stream bed and banks and re-vegetate with suitable indigenous vegetation. 17) All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded. 18) Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth. 19) Contaminated runoff from the construction site(s) should be prevented from entering the rivers. All materials on the construction site				

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			should be properly stored and contained. 20) Disposal of waste from the site should also be properly managed. Construction workers should be given ablution facilities at the construction site that are located at least 100m away from the river systems/ freshwater features and regularly serviced. 21) The laydown area should be cleaned and rehabilitated after construction is complete. 22) Stocking rates will need to be reduced during the respective construction phases in order to reduce the risk of overgrazing the remaining land portions. 23) Initiate land rehabilitation and re-vegetation as soon as possible.				
5.	**Visual impact**	The proposed site is visible to the public and a Construction site might have a negative visual impact on the sense of place, which is characterised by vast open plains.	**Objective:** To protect the sense of place. **Mechanism:** 1) Surface soil should be scraped off, conserved and used for rehabilitation. The remainder could be used for site development, and any surplus disposed of in a manner that appears natural. The top 50 - 100mm of naturally occurring substrate should be separated and then spread over finished levels. 2) The laydown area should be screened with shade cloth and dust prevention mitigations needs to be implemented during use to prevent wind-blown dust. 3) Site offices and structures should be limited to single-storey and they should be sited carefully to reduce visual intrusion. Colours should reflect shades of the surrounding vegetation and/or the ground. Roofs should	No complaints from the public.	ECO, Engineer and Contractor	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			be grey and non-reflective. Door and window frame colour should reference either the roof or wall colours. 4) Litter is to be regarded as a serious offence and no contaminants are to be allowed to enter the environment by any means. 5) Road construction and management must take run-off into consideration in order to prevent soil erosion. 6) Access roads are to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads. 7) The footprint areas of all impact sites utilised in construction should be rehabilitated in during the construction phase, and not during operation. Disturbed areas should be restored as near as possible to previous natural vegetation. 8) The fencing should be grey in colour and located as close as possible around the PV site. 9) If possible, natural waterways and drainage lines indicated as sensitive should not be fenced in.				
6.	**Impacts on local economy (Employment) and social conditions**	The activity might impact on the economy (local shops, restaurants, and Guest Houses, etc.)	**Objective:** To ensure on-going sustainability of the local tourism / hospitality industry. **Mechanism:** 1) It is recommended that the local Employment policy, as stated by the proponent, be implemented, audited and accompanied by a training programme. The policy must be based on a 'local's first' policy, specifically for low skilled jobs and should aim to recruit at least 20% of the jobs from the local	Contribute to local community upliftment	Contractor, ECO, Engineer	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			community. This should also apply to all contracting firms. 2) A local procurement policy should be adopted by the proponent to maximise the benefit to the local economy. The general contractor should be responsible to inform the sub-contractors of the contact details for all the local businesses offering related goods and services. 3) Implement a policy of "no Employment at the gate" to prevent loitering. 4) The site should be secured. 5) A comprehensive employee induction programme would cover land access protocols and fire management. This was addressed in the LEMPR. 6) A comprehensive employee induction programme would address issues such as HIV/ AIDS and Tuberculosis, as well as alcohol and substance abuse. The induction should also address a code of behaviour for employees that would align with community values.				
7	**Traffic**	Increased volume of traffic both on and off site	**Objective:** To ensure that increased traffic volume is managed efficiently to minimise associated impacts. **Mechanism:** 1) Comply with the traffic management plan and the transportation plan. 2) Ensure that road junctions have good sightlines. 3) Transport the materials in the least amount of trips as possible. 4) Implement traffic control measures where necessary.	Traffic is orderly, free flowing and controlled.	Contractor and Engineer	During the construction phase (from site establishment to contract completion)	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			5) Transport components overnight as far as possible. 6) Ensure that all drivers are aware of the "No-Go" areas, permissible roads, and where the offloading area is. 7) Impose speed limits on the construction site. 8) Manage site access to prevent congestion of vehicles and trucks. 9) Access of all construction and material delivery vehicles should be strictly controlled, especially during wet weather to avoid compaction and damage to the topsoil structure. 10) Roads not to be used shall be marked with a "NO ENTRY for construction vehicles" sign. 11) Access roads are to be kept litter free. 12) Transportation of materials must be done by the least amount of trips to prevent the construction vehicles from congesting the main roads leading to De Aar. 13) The contractor must ensure that there is ample space to off load the materials to prevent truck being delayed and interrupting the traffic flow. 14) Apply for the relevant permits from SANRAL should transportation of abnormal loads be required.				
8	**Dust**	Dust generated from the stripped surfaces, construction demolition, excavations and stockpiled materials can become a	**Objective:** To avoid nuisance impacts caused by dust as far as possible. **Mechanism:** 1) The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the ECO and Engineer.	No complaints received from public and or site staff. Dust fallout at the site should not exceed 1,200mg/m^2/day,	Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		nuisance to neighbouring landowners.	2) Water sprays to be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. 3) Ensure travel distance between clearing area and topsoil piles to be at a minimum. 4) Ensure exposed areas remain moist through regular water spraying during dry, windy periods. 5) Reshape all disturbed areas to their natural contours. 6) Cover disturbed areas with previously collected topsoil and replant native species. 7) Minimise the time that stripped areas are exposed. 8) Protect open soils against wind erosion. 9) Put in place procedures for effective cleaning of vehicles and inspection. 10) Material loads must be covered properly during transport and storage thereof. 11) The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of both natural and manufactured materials. 12) Establish a dust monitoring network comprising of four single dust fallout units. Dust buckets should be placed at the following locations: • One to be placed downwind to the north-west of the proposed development (dust fallout limit 1,200mg/m²/day). • One to the south-east of the proposed development (dust fallout limit 1,200mg/m²/day). • One dust fallout unit should be placed	and not exceed 600mg/m^2/day off-site in the direction of the town and the farm Wag-'n-Bietjie, for any three months in a calendar year or for two consecutive months.			

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			between the proposed development and the town of De Aar on the western side of the development (dust fallout limit 600mg/m²/day). • A fourth unit should be placed on the eastern boundary of the proposed development, in the direction of the farm Wag-'n-Bietjie (dust fallout limit 600mg/m²/day).				
9	**Noise**	The increase in traffic and operation of equipment may result in noise becoming a nuisance.	**Objective:** To ensure that the construction phase are compliant to noise regulations. **Mechanism:** 1) Construction site yards, workshops, concrete batching plants, and other noisy fixed facilities should be located well away from noise sensitive areas. 2) Stationary noisy equipment such as compressors and pumps should be encapsulated in acoustic covers, screens or sheds where possible. Portable acoustic shields should be used in the case where noisy equipment is not stationary (i.e. angle grinders, chipping hammers). 3) Vehicles should avoid unnecessary use of the reverse gear to minimise annoyance caused by reverse sirens. Consideration of alternative safety measures may be necessary when taking such a measure. 4) All diesel powered equipment must be regularly maintained and kept at a high level of maintenance. This must particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment must serve as trigger for withdrawing it for	No complaints received from public and or site staff.	Contractor and ECO	During the construction phase (from site establishment to contract completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			maintenance. 5) Truck traffic should be routed away from noise sensitive areas, where possible. Noisy operations should be combined so that they occur where possible at the same time. 7) Instruction of employees on low-noise work methods, for example, the handling of structural steel and the use radiotelephony rather than shouting for communication. 8) Machines in intermittent use should be shut down in the intervening periods between works or throttled down to a minimum. 9) Construction activities are to be contained to reasonable hours during the day and early evening. 10) Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends from 14h00 on Saturday afternoons to 06h00 the following Monday morning. 11) With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents and owners on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities				
10	**Impact on archaeological, cultural and historic sites**	Heritage resources can be impacted on during the site clearance, earthworks and the constructing of the PV panels.	**Objective:** To ensure that no heritage resources as identified in the Heritage Impact Assessment report are disturbed and or destroyed. **Mechanism:** 1) All PV layouts for both alternatives should avoid the dolerite ridge which has a high density of archaeological remains associated	No heritage resources are Disturbed and SAHRA was contacted in the event of uncovering an archaeological artefact.	ECO and contractor	During the construction phase (from site establishment to contract completion).	

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			with it. This has already been factored into the design. Archaeological mitigation in the form of excavation, sampling and analysis should be carried out for the MSA and LSA sites that will be impacted. 3) Once the exact lines have been identified for the linear components of the project, they should subject to a desktop evaluation and depending on the findings, a walk-down of the route may be required. 4) Where archaeological sites cannot be avoided, mitigation in the form of excavation and collection of artefacts must be carried out. 5) If any human remains are encountered during the development they must be cordoned off and protected from further harm until they can be inspected and removed by an archaeologist under a permit issued for that purpose. 6) All mitigation-worthy archaeological sites that are avoided by the development and are not mitigated should be protected from incidental damage by demarcating them as no-go areas (for example from vehicles driving over them or through the establishment of power line access tracks). 7) Any dense subsurface concentrations of artefacts found during excavations should be protected *in situ* and immediately reported to an archaeologist for assessment. 8) Any areas of the landscape, particularly the rocky hills that are not to be developed, should be protected so as to minimise unnecessary landscape scarring.				

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			9) The ECO must be informed if archaeological resources are found on the surface or exposed by fresh excavations during construction activities. 10) Should substantial fossil remains be discovered during construction, these should be safeguarded (preferably in situ) and the ECO should alert SAHRA so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. 11) No-Go areas identified by the Heritage Specialist must be demarcated and all site personal must be informed thereof.				
11	**Impact on municipal services**	The proposed activity will require municipal services in terms of sewage, waste removal, and provision of water.	**Objective:** To ensure that the Emthanjeni Municipality will be able to accommodate the proposed activity without jeopardising the security of services provided. **Mechanism:** 1) Ensure that service level agreements are in place prior to the commencement of the construction phase.	Services can be provided for the proposed activity.	The Developer and Engineer	Prior to the commencement of the construction phase.	ECO
12	**Hazardous substances**	Impact on soil and water.	**Objective:** Secure safety, to avoid soil and water contamination **Mechanism:** 1) Procedures detailed in the Materials Safety Data Sheets (MSDS) shall be followed in the event of an emergency situation. 2) Potentially hazardous substances shall be stored, handled and disposed of as prescribed by the Engineer. 3) An effective monitoring system to detect any	Correct handling, use and storage of materials, including hazardous materials. MSDS are available for all hazardous substances stored on site. Appropriate hazardous waste	Contractor monitored by the ECO	During Construction Phase (from site establishment to Contract Completion).	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			leakage or spillage of all hazardous substances during their transportation, handling, use and storage shall be compiled and implemented. This shall include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems. 4) Shutter oil and curing compound shall be stored and dispensed within a bunded area, and not located closer than 32 m from river banks / water courses / drainage lines. 5) Hazardous wastes e.g. mixed cement shall only be disposed at landfill sites registered for hazardous wastes. 6) All waste hazardous materials must be carefully stored as advised by the ECO, and then disposed of at a licensed landfill site. 7) All necessary precaution measures shall be taken to prevent soil or surface water pollution from hazardous materials used during construction. 8) No hazardous waste may be buried or burned under any circumstances. 9) The Material Safety Data Sheet (MSDS) for any hazardous materials must be kept on site at all times. 10) The contractor must ensure that the Employees are informed on how to responsibly dispose of any containers containing hazardous substances. 11) All major spills of any materials, chemicals, fuels or other potentially hazardous or pollutant substances must be cleaned immediately and the cause of the spill investigated. 12) Preventative measures must be identified	spill kits are available on site.			

No	ASPECT	IMPACT	MITIGATION MEASURE (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			and submitted to the ECO.				
14.	**Solid waste management**	The incorrect management of solid waste can result in the pollution of soil, groundwater and the general environment. Windblown litter can also contribute to a negative visual impact. Windblown litter consumed by grazing animals can result in fatality.	**Objective:** To avoid soil and water contamination as well as windblown litter. **Mechanism:** 1) Provide adequate waste bins. 2) Set up system for regular waste remova to an approved facility. 3) Minimise waste by sorting wastes into recyclable and non-recyclable wastes (an independent contractor can be appointed to conduct this recycling if practical). 4) No waste may be buried or burned under any circumstances. 5) An approved waste disposal contractor must be Employed to remove and recycle waste oil, if practical. 6) A housekeeping team should be appointed to regularly maintain the litter and rubble situation on the construction site. 7) Littering by the employees shall not be allowed under any circumstances. 8) The ECO shall monitor the neatness of the work site as well as the Contractor campsite. 9) Skip waste containers should be maintained on site. These should be kept covered and arrangements made for them to be collected regularly to prevent vermin and odours. 10) A certificate of disposal by shall be obtained the Contractor and kept on file, if relevant.	No complaints from public. No windblown litter. No contamination of soil and or water. No deceased animals due to windblown litter consumed. Certificate of disposal at approved waste site are available. MSDS are available for all hazardous substances stored on site. Appropriate hazardous waste spill kits are available on site.	Contractor, ECO	During the construction phase (from site establishment to contract completion).	ECO

4.6 CEMPR: Establishment of the construction camp

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	**Demarcate the construction camp**	Without properly demarcating the site, the surrounding vegetation might be impacted on through rampling, compaction of the soil etc. Windblown litter might also become problematic	**Objective:** Prevent construction activities from impacting on surrounding vegetation. **Mechanism:** 1) The ECO and Engineer shall be advised of the area that the Contractor intends using for the Construction Camp. 2) All Construction Camps are to be fenced off in such a manner that unlawful entry is prevented. 3) Any windblown litter must be removed on a regular basis. 4) Signage shall be placed at all access points in compliance with all applicable occupational health and safety requirements.	Temporary or permanent fencing in place.	Contractor	Prior to the commencement of site clearance.	ECO, Engineer
2.	**Stockpiling of Equipment and materials**	Storing materials wrongly can result in water and soil contamination, dust and or erosion.	**Objective:** Ensure that all materials and equipment stored do not cause environmental degradation. **Mechanism:** 1) The Engineer shall be advised of the areas that the Contractor intends to use for the stockpiling of materials. 2) All construction equipment must be stored within this construction camp. 3) Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected. 4) Impervious surfaces must be provided where necessary.	No public complaints	Contractor and ECO	During Construction Phase (from site establishment to Contract Completion).	ECO, Engineer
3.	**Storage and Handling of materials**	The incorrect storage and Handling of materials pose a	**Objective:** To ensure that materials are handled and stored in a manner that environmental contamination and safety hazards are limited.	Correct handling, use and storage of materials, including hazardous materials.	Contractor monitored by the ECO	During Construction Phase (from site establishment to	ECO, Engineer, Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		risk of environmental contamination and could jeopardise the safety of public/ site staff.	**Mechanism:** 1) Educate employees regarding specification requirements of the materials they handle. 2) Secure materials during transport. 3) Identify appropriate storage areas for stockpiling of materials, storage of hydrocarbons and storage of hazardous substances and ensure that these areas are appropriately prepared for their purpose. 4) Storage of materials must take into consideration the prevailing wind directions to reduce windblown dust. 5) Prevent and limit spillage of hazardous substances or substances with the potential to cause contamination of the environment. 6) Develop emergency protocols for dealing with spillages particularly where these pose a pollution risk or involve hazardous substances. 7) All oil changes must take place within a designated area on an impervious surface such as a concrete slab. 8) Contaminated runoff from the construction site should be prevented from entering freshwater systems. 9) Containers that contained toxic or harmful materials shall not be rinsed and re-used. 10) Such containers shall not be stored or disposed on site. These containers shall be destroyed to prevent re-use and disposed in accordance with the manufacturer's instructions at a permitted waste disposal facility. 11) Proper storage facilities which are bunded for the storage of oils, paints, grease, fuels, chemicals, and any hazardous materials to be used must be provided to prevent the soil	No incidents of environmental contamination. No accidents or incidents related to the handling of materials. No public complaints.		Contract Completion).	

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			and groundwater contamination. 12) The wall of the bunded area shall be of earth or concrete, and shall be designed to be liquid tight and to withstand a full hydrostatic head of water. The volumetric capacity of the bunded area will be a minimum of 110% of the volume of the largest tank. Should more than one tank be enclosed in the bunded area, then the capacity should be calculated on the volume of all the tanks stored within the bunded area. 13) All fuel storage area must be roofed to avoid creation of dirty stormwater. 14) Storage areas containing hazardous substances / materials must be clearly signposted. 15) The concrete batching plant must be contained within a bunded area. 16) Concrete mixing must only take place within designated areas. 17) Ready mixed concrete must be utilised where possible. 18) No stockpiling shall occur outside of the working area or within drainage channels.				
4.	**Ablution facility, recess area**	The lack of adequate ablution facilities and recess areas can Compromise the health of site staff and result in environmental degradation.	**Objective:** To minimise the potential environmental impacts associated with an influx of site staff. **Mechanism:** 1) The contractor shall establish a sufficient recess area within the construction camp. 2) The recess area should include a food preparation area with adequate washing facilities and bins. 3) The Contractor and Engineer shall ensure that the recess area and ablution facilities are positioned so as to limit visual intrusion on	Adequate ablution facilities are in place.	Contractor, Engineer and ECO	Prior to construction.	ECO, Engineer, Contractor.

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			neighbours or the greater environment. 4) No littering may take place. 5) A sufficient number of chemical toilets shall be provided by the Contractor in the construction camp area and at appropriate locations approved by the Engineer. 6) Temporary portable toilets shall not be located within 100m of the drainage channels located on site or along the road reserve. 7) The ratio of ablution facilities for workers should not be less than that required by the Construction Regulations of 2003 of the Occupational Health and Safety Act. 8) All temporary/ portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.				

4.7 CEMPR: Clearing of the site

Also refer to the Site Clearance Plan provided in Appendix D(d).

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	**Demarcating the site to be cleared**	Without properly demarcating the area to be cleared of vegetation might result in unnecessary vegetation removal. The surrounding vegetation might also be impacted on through trampling,	**Objective:** To keep the area to be cleared of vegetation to a minimum and avoid unnecessary impacts to surrounding vegetation. **Mechanism:** 1) The site must be clearly demarcated with fencing or orange construction barrier to keep clearing activities to a minimum. 2) No site staff is to be allowed in the area outside of the demarcated area to prevent trampling of surrounding vegetation.	Only the area required for the construction of the PV site are cleared	Contractor and ECO	Prior to construction	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		compaction of the soil and clearing etc.					
2.	**No-Go areas** No-Go areas are those areas which have been Designated by Specialists as sensitive environments which need to be conserved.	Without No-Go areas the free moving of site staff could result in impacts to the sensitive areas.	**Objective:** Manage on site biophysical components to ensure ecological health. **Mechanism:** 1) All areas outside of the designated construction footprint shall be declared a "No-Go" area. 2) No equipment shall be allowed outside the site and defined access routes, or within "no-go" areas, unless expressly permitted by the Engineer. 3) The ECO and Engineer must establish a penalty system to manage any non-compliance. 4) The ECO must keep record of any non-compliance.	Comprehensive record, including photographic record, of compliance available.	Engineer and ECO	During Construction Phase (from site establishment to Contract Completion).	ECO
3.	**Removal of vegetation**	By not limiting the removal of vegetation to a minimum can result in the destruction or loss of sensitive areas which could include indigenous vegetation, fauna, aquatic ecosystems or heritage resources.	**Objective**: To ensure that disturbance to sensitive areas or artefacts is minimised and minimise the extent of areas cleared **Mechanism:** 1) The entire site shall only be cleared as required. An estimated, 40% of the construction footprint should remain vegetated and be brush cut to a height of 40-50 cm to ensure foliage are left on shrubs. 2) Where possible, the removed vegetation should be left onsite to assist with water infiltration and reduce stormwater runoff. 3) The top 300mm of the soil layer shall be stockpiled for rehabilitation purposes. The topsoil stockpiles need to be protected against erosion, contamination and the	Limited extent of vegetation destroyed during construction activities. No topsoil contaminated.	Contractor and ECO	During the start of the construction period.	ECO

			establishment of alien vegetation. 4) Topsoil shall be stored in areas demarcated by the ECO and Engineer and stockpiles shall not exceed 2m in height. 5) If heavy rains are expected activities should be put on hold to reduce the risk of erosion. 6) Wind screening should be undertaken to prevent soil loss from the site. 7) Rehabilitation of completed sections with appropriate local indigenous vegetation shall start immediately and bare soil shall be protected against wind while vegetation re-establishes (or as required by the rehabilitation specialist). A practical solution should be determined by the contractor. 8) Soil remaining after construction and rehabilitation activities has been completed, shall be dispersed evenly, as a very thin layer of soil. 9) Once construction is complete, disturbed areas shall be rehabilitated and maintained with appropriate local indigenous vegetation.				

4.8 CEMPR: Construction of the PV panels and associated infrastructures

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	**Excavations for foundation structures and potential pipeline**	In order to anchor the PV panels excavations will be required which might impact on the environment. A pipeline might be required depending on the source of water opted for.in	**Objective:** To limit the impact to the environment caused by excavations. **Mechanism:** 1) Any surplus materials from excavations that cannot be used on site during the construction phase must be disposed of in an environmentally sound manner. 2) Materials may be used in local construction activities.	No heaps of materials left on site after the construction phase.	Contractor, ECO	During Construction Phase (from site establishment to Contract Completion)	ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		order to construct the pipeline excavations will be required which might impact on the environment	3) The ECO must be informed if historical artefacts are found on the surface or exposed by excavations. 4) Trenches shall be appropriately demarcated and regularly monitored during operations to ensure that pedestrian (and vehicular) access to these areas is strictly prohibited.				
2.	**Construction of transmission lines**	Transmission lines might result in negative environmental impacts	**Objective:** To construct the transmission lines whilst limiting environmental impacts **Mechanism:** 1) Demarcate the area proposed for transmission line construction in order to prevent site staff from damaging nearby vegetation. 2) All new powerlines should be adequately insulated and marked with bird flight diverters along their entire length.	No damage to vegetation adjacent to area proposed for transmission line construction. No significance changes are recorded in the number, distribution or breeding behaviour of priority avifauna species (bird monitoring programme).	Contractor	During Construction Phase	ECO

4.9 CEMPR: Removal of construction related debris, materials or equipment

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	**Removal of equipment, materials and any temporary structures**	If the construction camp is not decommissioned it can result in environmental degradation.	**Objective:** To rehabilitate the impacted area to an acceptable state as close to the original state. **Mechanism:** 1) All construction related structures are to be removed from site. 2) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc., and these shall be cleaned up. 3) All hardened surfaces within the construction camp area should be ripped and rehabilitated. 4) Surfaces are to be checked for waste products from activities such as concreting and cleared in a manner approved by the Engineer. 5) All rubble is to be removed from the site to an approved disposal site as approved by the Engineer. 6) Burying of rubble on site is prohibited. 7) Temporary fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Engineer. 8) The Contractor must repair any damage that the construction works has caused to neighbouring properties. 9) Rehabilitate and re-vegetate cleared areas with indigenous plant species.	The area impacted by the construction activities are rehabilitated and pose no threats to the environment.	Contractor, Engineer and ECO	After the construction phase before the operational phase can commence.	ECO

4.10 CEMPR: Minimising Construction Risks to Health & Safety

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
HEALTH RISKS						
H1	Chronic Chemical or Biological Toxic Exposure	Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc.	The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction risk assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date. All necessary health controls/ practices to be in place, e.g. ventilation of welding and painting areas. SHE monitoring and reporting programs in place.	Illness.	Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	
		Human pathogens and diseases, sewage, food waste.	All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls.	Illness and at worst without mitigation, possibly extending to fatalities.	Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others.	
		Snakes, insects, wild and domesticated animals and harmful plants.	Prior to construction determine the dangerous species in the area and what responses are needed to bites/exposure/attacks. Awareness training for persons on site, safety induction to include animal hazards.	Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc.	First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.	
H2	Noise	Drilling, piling, generators, air compressors	The construction phase will be the noisy phase of the project. No extreme construction envisaged, normal road, single storey building type construction similar to what would take place in a residential area.	Adverse impact on hearing of workers. Nuisance factor in near -by residential areas, e.g. BESS 3.	Health risk assessment to determine if equipment continuous noise exceeds 85dB at workstation and 61dB at boundary of the site employees to be provided with hearing protection if working near equipment that exceeds the noise limits. Due to rural nature of sites, construction is unlikely to continue at after sunset.	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
					BESS 1 and 2 located 3km from residential areas.	
H3	Environmental	Heat during the day. Enclosed containers. Cold in winter.	Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces.	Heat stroke. Hypothermia.	Adequate potable water to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the plants during all phases of the project.	
H4	Psychological	Large projects bring many contractor workers into a small isolated community.	Depending on size of contract and scope, project may need to provide temporary accommodation, regular/periodic transport to town and nearby cities.	Lack of sufficient accommodation, entertainment etc. Increase in alcohol abuse, violence.	Local community involvement and preferably use of local persons as contract workers on the project.	Note. In small isolated communities, use of locals for construction projects is critical for community safety and upliftment.
H5	Ergonomics	Lifting heavy equipment. Awkward angles during construction.	Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. Development of local service providers.	Back and other injuries.	First aid provision on site.	
SAFETY RISK						
S1	Fire	Damaged on route e.g. dropped in port (drops do happen about 1/2000 containers) and importing 500 containers it is possible that one will be dropped, traffic accident on-route. Involvement in an external fire e.g. at the port or on route.	Design includes abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g. heat insulating materials between cells/modules. Factory acceptance test prior to prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life, but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. Port Authorities need to be alerted to the overall project and the hazardous nature of the contents. Port emergency response in particular need training on mitigating battery hazards.	Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in S3 below for the major impact).	Emergency plan to determine: What gases would be released in a fire Are there inhalation hazards Extinguishing has two important elements, put out fire and to provide cooling. Different approaches for small fire – put out, and large fires cool with copious quantities of water. Inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. What initial fire extinguishing medium should be used? Are there any secondary gases or residues from use of extinguishers? If water is appropriate, may need outside connections to inside sprinklers	Note. If, as per Tesla indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables.

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
			Prior to bring any containers into the country a full Emergency response plan should be in place for the full route from the ship to the site. Data indicates installed facility events are 0.001/year. Transport of +500 units assumed to take 4 weeks each so f= 0.04 once in 25 years so L=2.		First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. Must the container be left unopened or opened? PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. Containment of residues/water/damaged equipment. Suitable safe making a disposal plan considering after the event, how do responder deal with partially charged damage units, contaminated surfaces (e.g. HF residues).	
S2	Explosion	Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static.	During transport this is only likely to happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out.	Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g. other container in the port.	For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. Once an import route has been chosen, e.g. Cape Town port and up the N1, then key emergency services on route could be given awareness training in battery fire/accident response. Emergency response planning and training referred to above may be important for key locations such as the Du Toitskloof tunnel.	
S3	Acute Chemical or Biological Toxic Exposure	Damaged batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released.	Transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g. consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport etc. Transport in sealed packages that are kept upright, protected from movement damage etc. Also packaged to ensure no short-circuiting during transport. Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during	Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.	Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. Route selection to consider possible incidents along the way and suitable response, e.g. satellite tracking, mobile communication, 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels, Trem cards, driver trained in the hazards of the load.	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
			commissioning. Likelihood similar to fire above.			
S4	Acute physical Impact or violent release of energy	Construction moving equipment, heavy loaded, elevated loads, working at heights.	Refer to item H1 above for OHS Act issues. Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers etc also to relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins.	Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses.	Emergency response plan to be in place before construction begins.	
S5	Generation impact	Use of electrical machines, generators etc.	Standard maintenance of condition of electrical equipment and safe operating instructions.	Electrocution.	Ability to shut off power to systems in use on site.	
		Hot dry area static generation is highly likely.	If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge.	Ignition and burns.	If decanting fuels ensure installations are to standard with regards static.	
		Lightning strike.	Lightning strike rate in De Aar is relatively low, but not impossible. Advised stop outside work during thunder storms.	Injury and death. Damage electrical equipment. Possible start for thermal run away within containers.	Lighting conductors will likely be required for the final installation.	
ENVIRONMENTAL RISKS						
E1	Emissions	Dust from construction and generally hot dry area.	May need to use dampening on roads etc. as per normal construction practices. There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance.	Adverse impact on employee health. Nuisance factor in residential areas if close, e.g. BESS 3.	May need PPE (dust masks) for specific construction workers. There will need to be waste segregation (e.g. electronic equipment, chemicals) and management on the site.	
E2	Pollution	Diesel for equipment, paints and solvents. Transformer oil spills.	Normal construction site practices for preventing and containing fuels/paint/oil etc spills. Sewage and any kitchen liquids - containment and suitable treatment/disposal.	Environmental damage.	Spill clean-up procedures to be in place before commencing construction.	
E3	Waste of resources	Battery containers damaged	Handling protocols to be provided by supplier.	Loss of production capacity.	End of Life plan needs to be in place before any battery containers enter the country as there may	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
					be damaged battery unit from day 1.	
GENERAL RISK						
G1	Aesthetics	Bright surfaces reflecting light. Tall structures in a flat area.	Design indicate structure limited to 25m for electrical infra structure. Container singe storey as physical space is not a constraint that would require stacking of containers. Containers likely to be painted white, not left as reflective steel.	Irritation.	None.	
G2	Financial	Defective technology. Extreme project delays.	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	Financial loss	Project insurance for construction phase.	
G3	Security	On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities.	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. Isolated location both helps and hinders security.	Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Night lighting unlikely to be provided, but could be considered.	
G4	Emergencies	Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation.	All safety measures listed above. Small events not handled correctly and escalate into larger events.	Injuries turn to fatalities, small losses become extended down time.	If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. Except during shipping, ideally the units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented. The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g. if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
					truck with a container that stops in a small town for driver refreshments.	
G5	Legal compliance	Field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology.		Unknown hazards manifest due to using "cheaper supplier or less developed technology".	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only latest state of the art battery system is used.	

4.11 Temporary site closure

If the site is closed for a period exceeding one week, the contractor, in consultation with the Engineer shall carry out the following checklist procedure.

Hazardous materials stores

- Outlet secure/ locked
- Bunded area (where applicable)
- Fire extinguishers serviced and accessible
- Secure area from accidental damage e.g. vehicle collision
- Emergency and contact details displayed
- Adequate ventilation

Safety

- All trenches and manholes secured
- Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1193)
- Emergency and Management contact details displayed
- Stockpiles wedged/ secured

Erosion

- Wind and dust mitigation in place
- Slopes and stockpiles at stable angle

Water contamination and pollution

- Cement/bitumen and materials stores secured
- Toilets empty and secured
- Refuse bins empty and secured
- Structures vulnerable to high winds secure.

4.12 Penalties

Penalties will be issued for the transgressions listed below. Penalties may be issued per incident at the discretion of the Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications. The Engineer will inform the Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract. A penalty register shall be kept and shall be made available to the DFFE on request.

Table 3: Penalties to be imposed by the Engineer or the Contractor

a)	Any Employees, vehicles, plant, or item related to the Contractor's operations operating within the designated boundaries of a "no-go" area.	R10 000
b)	Any mechanised excavation equipment related to the Contractor's operations operating within the designated boundaries of a "no-go" area abutting the two streams.	R10 000
c)	Any vehicle driving in excess of designated speed limits.	R 1 000
d)	Persistent and un-repaired oil leaks from machinery.	R 3 000
e)	Persistent failure to monitor and empty drip trays timeously.	R 1 000
f)	Litter on site associated with construction activities.	R 1 000
g)	Deliberate lighting of illegal fires on site.	R 5 000
h)	Employees not making use of the site ablution facilities.	R 2 000
i)	Failure to implement specified noise controls	R 2 000
j)	Failure to empty waste bins on a regular basis.	R 1 000
k)	Inadequate dust control.	R 5 000
l)	A spillage, pollution, fire resulting from negligence on the part of the Contractor.	R10 000
m)	Any act, that in the reasonable opinion of the Engineer, constitutes a deliberate contravention of the requirements of these Specifications	R 5 000

For each subsequent similar offence the penalty shall be doubled in value to a maximum value of R50 000.

4.13 Amendments to CEMPR & Registers

Amendments to the CEMPR must be submitted to and approved by the DFFE before the changes are commenced with.

Furthermore, copies of the attendance registers for all environmental awareness training, complaints registers, penalty registers and method statements must be kept and made available to the DFFE on request.

CHAPTER 5: OPERATIONAL EMPR

This section contains the Operational Framework EMPR. It is important to note that this Framework OEMPR has been compiled prior to authorisation of the proposed project and will be updated to include the conditions of the EA that will be issued by DFFE as part of the EA.

The information is summarised in tabular format below illustrating the activity, aspect, impact, mitigation measure, performance indicators, resources, schedule and verification. These criteria are listed and explained below:

The following components are identified/ described:

- Activity: component / activity of the project for which the impact has been identified;
- Aspect: the aspect of the above activity which will be impacted;
- Impact: the environmental impact identified and to be mitigated;
- Mitigation measure: measures identified for implementation in terms of environmental management to reduce, rectify or contain the identified environmental impact – mitigation is divided into the following:
  - Objective: desired outcome of mitigation measure,
  - Mechanism: method of achieving the objective;
- Performance indicators: outcomes that will indicate achievement of objective/s;
- Responsibility: party or parties identified for implementation of mitigation measure/s;
- Resources: available resources to aid implementation of mitigation;
- Schedule: timeframe in which identified impact and mitigation measure is anticipated to occur; and
- Verification: party or parties identified as responsible for review and assessment of final outcome.

5.1 OEMPR : General

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
1.	Environmental management documentation and procedures	No framework within which to locate the management of the operational phase. No procedures against which to assess environmental performance during the operational phase and thus no measure of compliance.	**Objective:** To ensure that the operation of the solar energy facility does not result in avoidable impacts on the environment, and that any impacts that do occur are anticipated and managed. **Mechanism:** 1) Appoint a suitably qualified ECO (either independent or in-house) to monitor compliance and conduct the environmental audit. 2) Audit the compliance with the requirements of the environmental specification contained within the OEMPR.	Environmental impacts effectively monitored and managed during the operational phase. Comprehensive record of compliance and remedial actions available to Mulilo and the authorities	The Contractor	Twice in the 1st three years and then once every five years	The Developer
2.	Environmental management of the operational phase	Positive impacts on socio-economic environment during operation	**Objective:** To ensure that the operation of the solar energy facility maximises positive impacts on the socio-economic environment. **Mechanism:** 1) Train local people for operation and maintenance of facility. 2) Employ local labour for the operational phase, where possible, and particularly for day to day operations and maintenance.	Consult annual skills and training records, Employment records and proof of staff residency in the area prior to Employment.	The Contractor	During Operational Phase (full lifetime) when the need arise to Employ people.	The Developer
3.	Protection of fauna, flora and avifauna	Constructing a PV facility may have impacts on the vegetation. The site will be cleared of all vegetation and this area could become prone to alien species.	**Objective:** To prevent unnecessary disturbance to natural vegetation. **Mechanism:** 1) The rehabilitation plan for the site should be implemented and adhered to during the operational phase. 2) An on-going monitoring programme should be implemented to detect and quantify any	No animals are injured. No employees enter the no-go areas. No alien vegetation establishment.	The Contractor	During the construction phase (from site establishment to contract completion).	The ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			aliens that may become established and provide information. 3) Minimizing noise and disturbance associated with maintenance activities at the plant once it becomes operational for the management of aliens. 4) The small ground level openings in the electrical or barbwire fence, 20-30 cm in height, should be kept clear to allow for small mammals and reptiles to move through the site. 5) Minimising the amount of fencing used to enclose the development areas, given that these may present a collision risk for collision-prone birds. 6) New aboveground lines should be fitted with bird flight diverters and marked along their entire length. High risk areas identified during the avifauna monitoring assessment shall be fitted at all times with bird flight diverters.	Invasive alien vegetation monitoring programme implemented.			
4.	Stormwater runoff, erosion, and pollution of surface water and groundwater resources.	Contamination of stormwater runoff can impact on the surface and groundwater resources he mismanagement of stormwater can furthermore result in erosion.	**Objective:** Prevent stormwater from eroding the land and becoming contaminated. **Mechanism:** 1) There will be an approved storm water management plan in place for the operation phase of the project. Storm water runoff from the constructed areas should also be visually monitored after large rainfall events to ensure that eroded areas do not develop, particularly within the drainage channels. 2) Invasive alien plant growth within the disturbed areas should be visually monitored at least every three months and any regrowth of invasive alien plants removed. 3) Storm water runoff from the constructed areas should be monitored to ensure that	Stormwater not Contaminated by construction activities. Stormwater control measures are effective at regulating runoff from the site and erosion channels do not develop. Freshwater ecosystems are not unduly disturbed by construction activities within the drainage channels.	Contractor	After site clearing has taken place up to the end of the construction phase.	Developer & ECO

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			eroded areas do not develop, particularly within the drainage channels. 4) Should soil chemistry be affected (this is likely to be an increase in salinity), the nature of the washing mixture could be changed, or acceptable waste treatment employed; 5) Install composting toilets that does not require water, septic tanks or soak-aways; 6) Disturbed areas within the riparian zones and stream beds should be rehabilitated as soon as possible after construction has been completed and revegetated with suitable indigenous vegetation. 7) Initiate land rehabilitation and re-vegetation as soon as possible and continue to visually monitor land for early detection of degradation. 8) It is recommended that more palatable species form part of the re-vegetation plan to enable faster stocking initiation. 9) Allow normal agricultural activities to continue in unaffected areas. 10) Allow periodic grazing within the PV facility (sheep and wildlife). This mitigation will minimise the loss of grazing land and reduce the impact on agricultural production.				
5.	Visual impact	The proposed site is visible to the public and a construction site might have a negative visual impact on the sense of place.	**Objective:** To protect the sense of place. **Mechanism:** 1) All lighting is to be kept to a minimum, within the requirements of safety and efficiency. 2) Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, should be used. 3) No naked light sources are to be directly visible from a distance. Only reflected light	No complaints from the public.	Engineer and Contractor	During the construction phase (from site establishment to contract completion).	Developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
			should be visible from outside the site. 4) Any necessary aircraft warning lights are to be installed as per the relevant authority requirements. 5) External lighting must use down-lighters shielded in such a way as to minimise light spillage and pollution beyond the extent of the area that needs to be lit. 6) Security and perimeter lighting must also be shielded so that no light falls outside the area needing to be lit. Unnecessarily tall light poles are to be avoided. 7) To limit the potential of sunlight reflecting off the panels creating glint and glare impacts, it is recommended that the Fixed Tilt structure is utilised.				
6.	Impacts on local economy (Employment) and social conditions	The activity might impact on the economy (local shops, restaurants, and Guest Houses, etc.)	**Objective:** To ensure on-going sustainability of the local tourism / hospitality industry. **Mechanism:** 1) It is recommended that the local Employment policy as stated by the proponent is implemented, audited and accompanied by a training programme. 2) It is recommended that the developer adopts a local procurement policy which would maximise the benefit to the local economy and minimise leakage.	Contribute to local community upliftment	Contractor, Engineer	During the construction phase (from site establishment to contract completion).	Developer
7.	Noise	The increase in traffic and operation of equipment may result in noise becoming a	**Objective:** To ensure that the construction phase are compliant to noise regulations. **Mechanism:** 1) Maintain reasonable noise complaints registered and ensure that any complaints	No complaints received from public and or site staff	Contractor	During the operational phase.	Developer

No	ASPECT	IMPACT	MITIGATION MEASURE: (objective and mechanism)	PERFORMANCE INDICATOR	RESPONSIBILITY	SCHEDULE	VERIFICATION
		nuisance.	are addressed in a timeous manner. The developer must implement a line of communication. 2) Good public relations are essential and the community involvement needs to continue throughout the project.				

5.2 OEMPR: Minimising the risk of the BESS

From the details of some of the accidents that have happened it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
HEALTH RISKS						
H1	Chronic Chemical or Biological Toxic Exposure	Operation and maintenance materials such as spare batteries, paints, solvents, welding fumes, oils etc.	The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. SHEQ policy in place. A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. SHE procedure in place, e.g. PPE specified, management of change, integrity monitoring. SHE appointees in place. All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place.	Illness.	Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as appointment of emergency controller, emergency isolation systems for electricity, provision of PPE for hazardous materials response, provision of shelter in place facilities for staff at the main office building, provision of first aid, first responder contact numbers.	The Contractor is to compile this Emergency response plan in consultation with the Employer and aligned with industry best practice
		Human pathogens and diseases, sewage, food	The number of persons on site will reduce	Illness and at	Policies and practice for dealing with	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
		waste.	significantly after construction and would likely be limited to half a dozen or so at any one time. Never the less all necessary good hygiene practices need to continue to be in place, e.g. provision of toilets, eating areas, infectious disease controls.	worst without mitigation, possibly extending to fatalities.	known vectors of disease such as Aids, TB, COVID 19 and others.	
		Snakes, insects, wild and domesticated animals and harmful plants.	Prior to construction determine the dangerous species in the area and what responses are needed to bites/exposure/attacks. Awareness training for persons on site, safety induction to include animal hazards.	Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc.	First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. The ERP must include the contact details for a local Doctor with the required immediate access to the antivenom or other treatments.	
		Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces.	Batteries sealed. Individual batteries in modules which are also sealed. Pre-packed in the container. Maintenance procedures will be in place. PPE will be specified for handling batteries and other equipment on site.	Dermatitis, skin /eye/lung irritation.	Possible detectors with local alarms if exceed STEL etc prior to entry for inspection. Labelling of batteries None walk-in containers for the BESS would be advised and should be specified. Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. Maintenance manuals with make safe, decontamination and repair procedures. Proposed maintenance schedules daily, weekly, monthly, annual etc. Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared cameras.	
H2	Noise	Moving parts inside containers, cooling systems etc.	Design to ensure continuous noise does not exceed 85dB in the containers or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	Adverse impact on hearing of workers. Nuisance factor in near -by residential areas, e.g. BESS 3.	Generators are located outside residential areas.	
H3	Environmental	Heat during the day.	Container facilities to comply with	Heat stroke.	Adequate potable water to be provided	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
		Batteries generate heat within enclosed containers. Cold in winter.	Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Battery life optimal at temperature also optimal for humans. Lighting to be provided inside the containers, possibly linked to the door opening.	Hypothermia.	during all phases of the project. Night work is unlikely unless there is major outage, suitable lighting to be provided. PPE for operations and maintenance staff to be suitable for the weather conditions.	
H4	Psychological	Isolated work station and monotonous repetitive work.	Staff rotation to other sites may be necessary.	Low performance, system productivity suffers.	Performance monitoring of inspections / maintenance tasks in particular will be necessary.	
H5	Ergonomics	Lifting heavy equipment. Awkward angles during maintenance, stretching reaching top high level batteries and bending to low level batteries. Working ta height if equipment located on top of container or elevated electrical equipment (e.g. pylons).	Training in lifting techniques.	Back and other injuries.	If batteries are at height, ensure suitable safe (electrically and physically) ladders are available. Working at height procedure to be in place.	
SAFETY RISKS						
S1	Fire	Involvement in an external fire e.g. veld fire, maintenance vehicle fire, electrical systems fire. Excessive dust ingress insulates causing heat to build up. Manufacturing defects or contamination. Damage to battery leading to shorting and heating. High humidity condensation of water shorting Ingress of water shorting. Flooding of containers. Excessive electrical loads - surges Mechanical damage, impact deformation. Operator abuse Low temperature – plating of lithium on the anode and shorting BMS failure or software failure. Thermal separation or insulation or spacers	Grass cutting and fire breaks around the site to prevent veld fires. No combustible materials to be stored in or near the battery containers. Design codes from USA and standards of practice UL9540, NFPA 855 and DNV GL RP 43. Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each model and the overall system. BMS should be checking individual cell voltage as well as module/rack, container, system	Contaminated run off. Radiation burns unlikely to be severe as not highly flammable materials. No affected bystanders. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled.	Refer to construction phase above and apply. LEL gas detector for flammable and shut down system. Emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address extinguishing, ventilating, entering as appropriate or not. 24/7 help line for local authorities in De Aar – fire, spills etc PPE include fire retardant, chemically	Note. Refer to Appendix A for an initial approximation of worst case possible fire impact zones.

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
		damaged, propagation. Thermal run away and resultant battery compromised and fire. Incorrect extinguishing. medium, escalate the fire.	voltages/current etc. BMS tripping the cell and possibly the module, rack, container if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from module faults. Battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Suitable ingress protection level provided, e.g. IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS and alerts in the main control room. Effects of battery aging to be considered. Abuse tests conducted by supplier. Temperature monitoring to be in place. Data needs to be stored for trend analysis. Regular infrared scanning. Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. Data indicates an event frequency of 0.001 and with +500 units per installation this would mean an event every two years (L=4). Most events will be small not resulting in injuries but this is possible if the event is not controlled.		resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. Separation of site diesel tank, transformers etc from battery packs, Lightning protection – low strike rate but flat open areas. IR scanning to determine if batteries are still smouldering / are sufficient cooled to handle. Very NB batteries thought to be extinguished can re-ignite days/weeks later. Some suggest after batteries are removed then still be submerged in outdoor water troughs. Fire water for cooling adjacent equipment – BESS units. 100m hydrants. Can use fogging nozzles to direct smoke. Clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly Suitable fire extinguishing medium, and cooling mediums and adequate supply of both is critical. De Aar is a very dry area and water supply may be an issue. A planned fire response to prevent escalation to an explosion is critical.	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
					Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that the high temperature trips actually work.	
		Power Conversion System (PCS – DC to AC) cooling failure electrical fire	Failure of cooling on PCS or fires on other electrical equipment such as cooling system pump motors etc, and failure to trip the entire system and raise the alert.	Fire starts in PCS or another section or room and spreads to battery area.	Modern design put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether.	
S2	Explosion	Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O2 during decomposition - escalation	This is only really likely do happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. Modern state of the art containers have ventilation systems for vapours. Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment. Might be zone 2 due to possible leaks of electrolyte or generation of flammable gases un thermal run away.	Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g. other container in the port.	Emergency response plan and employee training referred to above is critical Suitable training of emergency responders in De Aar is critical. .	NOTE. Refer to Appendix A for an initial approximation of worst case possible explosion impact zones.
S3	Acute Chemical or Biological Toxic Exposure	Damaged batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above.	Batteries contained, modules contained and all inside a container that acts as bund. Refer to fire above as all the protective measures apply to prevent toxic smoke. Fumes tend to be directed upwards by the structure of the container.	Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage. For BESS 3 the effects may extend slightly into the north eastern sections	Refer to fire above as all the measures apply to mitigate toxic smoke. 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels. All operators/maintenance staff trained in the hazards.	NOTE Refer to Appendix A for an initial approximation of worst case possible noxious smoke impact zones.

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
				of the town of De Aar, i.e. sport club.		
S4	Acute physical Impact or violent release of energy	Moving equipment, pumps, heavy batteries at elevation, nip points, working at heights. Traffic accidents.	Apart from pumps, no major moving parts during operation. Maintenance equipment to be serviced and personnel suitably trained in the use thereof. Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if whole container or elevated structure removed/replaced. Traffic signs, rules etc in place on site.	Injury. Fatality in unlikely worst case, e.g. traffic accidents or fall from heights. Damage to equipment.	All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. Emergency response plan.	
S5	Generation impact	Electrical equipment in container and high voltages systems outside for connection to the grid. Electrified fences.	Codes and guidelines for electrical insulation. PPE to suit. Low voltage equipment (e.g. batteries) separated from high voltage (e.g. transmission to grid). Trained personnel – IEE 1657 – 2018. Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment e.g. testing devices, mobile phones – malfunction, permanent damage. Software also needs maintenance, patches, updates.	Electrocution. Mild impacts for low voltage systems, possibly fatal on high voltage systems.	Consider suitably located E-stops for the container and the other equipment on site.	
		Hot dry area static generation is highly likely.	PPE to consider static accumulation for entering the battery containers especially after a high temperature shut down where there could possibly be flammable materials.	Ignition and burns.	The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment in side and how to protect personnel who may enter to respond.	
		Lightning strike.	Lightning strike rate in De Aar is relatively low, but not impossible. Advise stop outside work during thunder	Injury and death. Damage electrical equipment. Possible start for	Lighting conductors will be required for the installation.	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
			storms.	thermal run away within containers.		
ENVIRONMENTAL RISKS						
E1	Emissions	Refrigerant release. Maintenance waste, e.g. packaging, oils etc.	Refrigerant is asphyxiant if released indoors it can accumulate and displace oxygen.	Fatal impact	Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation.	
E2	Pollution	Spills from batteries, coolant. Fire water runoff control.	Normal site practices for preventing and containing diesel/paint etc spills. Sewage and any kitchen liquids - containment and suitable treatment/disposal. Procedures for dealing with damaged/leaking batteries as well as clean-up of spills.	Localized environmental damage.	Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. Reportable Quantities NEMA	
E3	Waste of resources	Similar to construction phase.	End of Life plan to be on place.			
GENERAL RISKS						
G1	Aesthetics	Bright surfaces reflecting light. Tall structures in a flat area.	Design indicate structure limited to 25m for electrical infra structure. Container singe storey as physical space is not a constraint that would require stacking of containers. Containers likely to be painted white, not left as reflective steel.	Irritation.	None.	
G2	Financial	Defective technology.	Design by experienced contractors using internationally recognized and proven technology.	Financial loss	Project insurance.	
G3	Security	On site, theft or damage to equipment and battery installation facilities. Cyber security attacks aim at the National Grid.	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. Isolated location both helps and hinders security. There should be clear labelling on fences and containers that they have highly hazardous contents – e.g. Skull and Cross Bones or other	Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaways.	If no night lighting provided consider motion detection lights and CCTV.	

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Comments
			signs. Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled. Pass word controls, levels of authority etc. Protection of the National grid from Cyber-attacks accessing through the BESS.	Ransom of the national grid.	Cyber emergency procedures.	
G4	Emergencies	Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation.	All safety measures listed above. Storage of spare batteries (e.g. in stores o site or elsewhere) also needs to consider possible thermal run away.	Injuries turn to fatalities, small losses become extended down time.	Escape door open outwards, doors hooked open when persons inside. More than one exit from containers.	
G5	Legal compliance	Field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology.		Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only latest state of the art battery systems are used.	

CHAPTER 6: MONITORING PROGRAMMES

6.1 Avifaunal Monitoring Programme

AviSense provided a Pre-Construction Bird Monitoring Report included in Appendix D(g).

The anticipated impacts of the proposed solar PV development include habitat loss, displacement and disturbance of regionally endemic and/or red-listed species (imposed by construction and operation of the solar PV arrays spread across a considerable aggregate development footprint), possible mortality of large terrestrial species and raptors (resulting from collision with or electrocution on new power infrastructure), and possible changes in the avian species assemblage both within and around the development footprint (resulting from substantive changes in habitat quality that might benefit some species at the expense of others).

Note that the impact relating to collision and electrocution is mostly associated with the grid connection powerline which is addressed in another application with its associated EMPR.

The primary aims of pre-construction monitoring is to :

- Determine the densities of birds resident within the impact area of the PV facility before construction of the plant, and afterwards, once the plant become operational.
- Register and as far as possible document the circumstances surrounding all avian mortalities associated with the ancillary infrastructure of the PV facility for at least six months after the plant becomes operational.
- Register and as far as possible document the circumstances surrounding all other avian interactions with the solar arrays of the solar power plant for at least six months after the facility becomes operational.

Monitoring Protocols: Avian Densities before and after

Monitoring should take place once per quarter for a period of up to 12 months prior to construction and 12 months after construction (operation phase). However, due to the overall medium impact significance across all three sites associated with the MTHS project, monitoring could be reduced to once every six months and could be undertaken simultaneously for all three sites.

Results of first monitoring iteration

Seventeen walk transects were established within (n = 9) and outside (n = 5) of the proposed development area, and surveys of small terrestrial bird densities were measured along each of these transect lines as per the stipulated protocols. In combination with the data obtained in two further site visits, these initial density estimates establishes a baseline against which to estimate the numbers of Karoo endemic passerines displaced by the development, and to

monitor the effect of the built and operational PV facility on the density and community structure of surrounding passerine populations.

The work done was considered sufficient to constitute a baseline profile of the avifauna most likely to be affected by the proposed development.

Future monitoring

Provided that the climatic conditions during such a post-construction survey are broadly similar, comparison of the two datasets should allow for a far improved understanding of the net effects of solar PV facilities on the local avifauna, and the implications of further such developments, spread over a much wider cumulative area, on the conservation status of endemic Karoo birds.

Should the results from the monitoring programme show that the cumulative impacts from the multiple renewable energy projects in the De Aar area are causing high negative impacts on bird species on a local and regional scale (i.e. beyond a radius of 10km from farm Badenhorst Dam), DFFE shall be contacted by the specialist to discuss the merits of an integrated mitigation approach by all renewable energy facilities contributing to the cumulative negative impact on avifauna.

6.2 Erosion Management Plan

An Erosion Management Plan (included in Appendix D(c)) was compiled by Mulilo Renewable Energy specifically for the MTHS Project and must be implemented.

The main philosophy used for Civil Works should be “Light on Land” (LoL) and the objective is to respect the existing site conditions and avoid unnecessary soil disturbance. The design is to adapt the product to the original slope of the ground as far as possible whilst considering the resultant impact to the original environmental site conditions.

Erosion Control

- The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities.
- Where erosion and/or sedimentation, whether on or off the site, occurs despite the Contractor complying with the foregoing, rectification shall be carried out in accordance with details specified by the ECO.
- Where erosion and/or sedimentation occur due to the fault of the Contractor, rectification shall be carried out to the reasonable requirements of the ECO.
- Any runnels or erosion channels developed during construction or during the defects liability period shall be backfilled and compacted.
- Stabilisation of cleared areas to prevent and control erosion shall be actively managed. Consideration and provision shall be made for various methods, namely, brush cut packing, mulch or chip cover, straw stabilising (at a rate of one bale / 20 m2 and rotovated into the top 100 mm of the completed earthworks), watering, soil binders and anti-erosion compounds, mechanical cover or packing structures (e.g. Hessian cover).
- Traffic and movement over stabilized areas shall be restricted and controlled, and damage to stabilized areas shall be repaired and maintained to the satisfaction of the Engineer.

- Natural vegetation will be retained wherever possible and vegetation clearance will be restricted to only the areas needed for the execution of the works and rocks shall not be removed unless necessary for the safe movement of construction vehicles and the installation of equipment, keeping disturbance to a minimum to reduce the loss of material by erosion.
- Erosion control is to be implemented on any cleared areas where wind or water erosion is potentially a problem. The topsoil and vegetation are to be disturbed as little as possible by keeping “green areas” and controlling traffic.
- Crushing shall be favoured over uprooting to promote regeneration and prevent unnecessary erosion. Where uprooting is necessary, mechanical methods shall be favoured and cleared areas shall be stabilised as soon as possible.
- Off-road vehicle movement destroys vegetation and creates erosion problems. Vehicle movement during construction shall therefore be planned for within the design phase to ensure maximum protection of vegetation. No vehicular or pedestrian access will be permitted into natural areas beyond the demarcated boundary of the work area.
- Light equipment is to be utilised for access and deliveries into areas of unstable soils and in areas where erosion is evident wherever possible.
- Traffic flow, both vehicular and pedestrian, shall be strictly prohibited in areas outside of the designated work areas. In addition, once construction has been completed within a section, this section shall be deemed restricted.

Erosion Protection

- Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas.
- Retain natural trees, shrubbery, and grass species wherever possible.
- Do not permit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the Work Area.
- Avoid access into seasonally wet areas and / or turf soils during and immediately after rainy periods, until such a time that the soil has dried out.
- Utilise only light equipment for access and deliveries into areas of unstable soils, in areas where erosion is evident, and at stream and river embankments, as far as reasonably practicable.
- Limit vehicular access to rocky outcrops and ridges.
- Institute adequate sedimentation control measures at river crossings and when excavation or disturbance within riverbanks or the riverbed takes place.
- Address erosion donga crossings as river crossings, applying soil erosion control and bank stabilisation procedures as specified by the ECO.
- Do not allow erosion to develop on a large scale before effecting repairs. When in doubt, seek advice from the ECO.
- Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth.
- In general, slopes steeper than 1(V):3(H) or slopes where the soils are by nature dispersive or sandy, must be stabilised. The ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
    - Topsoil covered with a geotextile , plus a specified grass seed mixture.
    - A 50:50 by volume rock: topsoil mix 200mm thick, plus specified grass seed mixture.

- Logging or stepping (logs placed in continuous lines following the contours).
- Earth or rock-pack cut-off berms.
- Benches (sandbags).
- Packed branches.
- Ripping and / or scarifying along the contours.
- Stormwater berms.

- Near vertical slopes of 1(V):1(H) or 1(V):2(H) must be stabilised using hard structures, preferably with a natural look, and with facilities allowing for plant growth. The ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
  - Retaining walls (loffel or otherwise).
  - Stone pitching.
  - Gabions.
  - Shotcrete.
- Protect the slopes of all river diversions. One or more of the following methods may be used, as specified by the ECO:
  - Sandbags.
  - Reno mattresses.
  - Plastic liners and / or coarse rock (undersize rip-rap).
- Wherever possible, especially in sensitive areas, use rubber dams as river diversions.
- During the course of construction, the ECO may identify additional slopes in need of stabilisation and will specify actions in terms of the most appropriate approved method and technology.

Topsoil Conservation

- Ahead of all construction, borrowing and quarrying, strip the entire available topsoil layer.
- Stockpile separately from overburden (subsoil and rocky material).
- In the absence of a recognisable topsoil layer, strip the uppermost 300mm of soil.
- Co-ordinate works to limit unnecessarily prolonged exposure of stripped areas and stockpiles.
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area.
- Strip and stockpile herbaceous vegetation, overlying grass, and other fine organic matter along with the topsoil.
- Do not strip topsoil when it is wet.
- Store stripped topsoil in an approved location and in an approved manner for later reuse in the rehabilitation process.
- Stockpile topsoil stripped from different sites separately, as reapplication during rehabilitation must preferably be site specific. If necessary, keep a stockpile register.
- Do not mix topsoil obtained from different sites.

De-bushing and De-stumping

- Obtain permission from the ECO to proceed with debushing. Only debush specified areas.
- Utilise the method of debushing most appropriate for the environment and species in question. Favour mechanical rather that chemical methods wherever possible.
- Wood obtained from de-bushing and de-stumping remains the property of the landowner and must be stockpiled in areas designated by him and approved by the ECO.
- Dispose of remaining plant material and stumps as solid waste. Upon approval by the ECO, the plant material may be buried on site. Specifications for topsoil striping, backfilling of excavations and rehabilitation will apply in this regard.
- Only carry out de-stumping upon instruction by the ECO. In all other instances trees must be cut as close as possible to the ground level and roots retained (for soil binding and habitat creation).

6.3 Hazardous Chemical Monitoring Programme

A Hazardous Chemicals Monitoring Programme/Plan was compiled by iSHEcon. It is included as Appendix D(j) and it must be implemented.

This Hazardous Chemicals Monitoring Program (HCMP) serves as a guideline for the handling of hazardous chemicals associated with these PV, BESS and GENSET facilities during all phases of the project in terms of transport; construction; and operation.

The objectives of the HCMP are :

- Primarily to prevent the spill of hazards chemicals,
- To prevent or minimize harm and loss of human life, equipment, infrastructure and environmental resources,
- To promote preplanning and awareness for spill events, should they occur,
- To establish response procedures to be followed in the event of spills,
- To mitigate the effects of spills on the health and safety of all persons and on the environment.

The actions must be taken rapidly and appropriately by trained :

- Mulilo staff members
- Appointed 3rd party contractors
- External 3rd party spill response personnel
- External emergency response personnel as and when required.

This procedure is for the entire MTHS project and is applicable to all staff, persons, visitors, contractors and emergency responders who may be :

- Involved in the transport of equipment to any of the three MTHS sites
- Involved in the construction of any facilities at any of the three MTHS sites.
- Involved in the operational phase of the MTHS project

The procedure must be made available to employees and contractors, who, together with visitors, must be aware of these spill monitoring, preventative and response procedures.

The HCMP *inter alia* includes specifications in terms of the Roles & Responsibilities; Chemical Monitoring and Spill Preventative Measures; Spill Response Preparedness Planning and Spill Response Procedures.

The following tables list some of the expected materials on site and their primary hazards. These tables should be reviewed prior to construction, whenever a new contractor arrives on site or new phase of activities is undertaken and thereafter regularly during the operational phase of the facility. The HCMP is designed to prevent and/or mitigate any event relating to the following potential hazards :-

Transport

FACILITY/ACTIVITY	MATERIAL	POSSIBLE CAUSES
Vehicles	Fuels, oil, brake fluid etc.	Leaks. Overfilling of fuel tanks.

Constructional Phase

FACILITY/ACTIVITY	MATERIAL	POSSIBLE CAUSES
Vehicles	Fuels, oil, brake fluid etc.	Leaks. Overfilling of fuel tanks.
Raw materials delivery, storage and handling	Cement	Leaks. Inadequate mixing surfaces.
	Bitumen	Leaks. Inadequate mixing surfaces
	Paint and solvents	Leaks.
	Generator fuel (diesel)	Leaks. Overfilling of fuel tanks.
	Transformer oil	Leaks.
	Cleaning materials (solvents)	Leaks.
Battery units	Coolant fluid (glycol)	Leaks.
Personnel	Sewage	Conservancy tank overflow.
General	Emergency	Discharge of fire extinguishers.
		Contaminated fire water runoff.

Operational Phase

FACILITY/ACTIVITY	MATERIAL	POSSIBLE CAUSES
Vehicles	Fuels, oil, brake fluid etc.	Leaks. Overfilling of fuel tanks.
Raw materials delivery, storage and handling	Paint and solvents	Leaks.
	Generator fuel (diesel)	Leaks. Overfilling of fuel tanks.
	Transformer oil	Leaks.
	Cleaning materials (solvents)	Leaks.
Battery units	Electrolyte	Leaks.
	Battery contents (molten lithium/sodium/sulphur)	Leaks.

<table>
<tr><td></td><td>
<table>
<tr><th colspan="2">Chemical Composition</th><th>Molecular formula</th><th>CAS No.</th><th>Weight (%)</th></tr>
<tr><td colspan="2">Steel</td><td>---</td><td>65997-19-5</td><td>23-25</td></tr>
<tr><td rowspan="4">Cell</td><td>Lithium Iron Phosphate</td><td>$LiFePO_4$</td><td>15365-14-7</td><td>21-23</td></tr>
<tr><td>Carbon as Graphite</td><td>C</td><td>7440-44-0</td><td>9-10</td></tr>
<tr><td>Aluminum Metal</td><td>Al</td><td>7429-90-5</td><td>8-9</td></tr>
<tr><td>Copper Metal</td><td>Cu</td><td>7440-50-8</td><td>8-9</td></tr>
<tr><td rowspan="4">Electrolyte</td><td>Ethylene Carbonate</td><td>$C_3H_4O_3$</td><td>96-49-1</td><td rowspan="4">15-17</td></tr>
<tr><td>Dimethyl Carbonate</td><td>$C_3H_6O_3$</td><td>616-38-6</td></tr>
<tr><td>Ethyl Methyl Carbonate</td><td>$C_4H_8O_3$</td><td>623-53-0</td></tr>
<tr><td>Lithium Hexafluorophate</td><td>$LiPF_6$</td><td>21324-40-3</td></tr>
</table>
</td><td></td></tr>
<tr><td>Personnel</td><td>Sewage</td><td>Conservancy tank overflow.</td></tr>
<tr><td></td><td>Emergency</td><td>Discharge of fire extinguishers</td></tr>
<tr><td></td><td></td><td>Contaminated fire water runoff</td></tr>
</table>

CHAPTER 7: DECOMMISSIONING

The Power Purchase Agreement for the 75MW Badenhorst Solar PV2 facility is only valid for a period of 20 years after which the plant would most likely be decommissioned and the site rehabilitated. Should the PV plant be decommissioned, materials and infrastructure that could not be recycled would need to be disposed of at an approved landfill site. Infrastructure should be removed and disturbed areas rehabilitated in accordance to the specifications of a suitably qualified rehabilitation specialist during decommissioning.

Since the proposed PV plant comprises of inert materials (mostly steel, aluminium, glass), the residual risks associated with decommissioning would be negligible. Should the need arise to decommission the PV plant a decision would need to be made as to whether the infrastructure would be removed or left *in situ*. Roads which are no longer required after decommissioning should be scarified and the areas rehabilitated with the assistance of a rehabilitation specialist.

Materials will be recycled where appropriate, and any hazardous substances shall be removed and disposed of in terms of the requirements of the relevant legislation (e.g. Hazardous Substances Act, No. 15 of 1973) and SANS specifications.

A detailed decommissioning plan will be developed approximately 24 months before closure of the facilities. The Construction EMPR could be used as a guideline to facilitate the detailed decommission phase EMP.

Mitigation measures below are only provisional mitigation measures.

- All PV structures, associated structures and fencing should be removed and recycled.
- Internal roads should be ripped and then rehabilitated.
- All impacted footprint areas should be rehabilitated and restored to indigenous, endemic vegetation.
- A decommission plan should be drawn up and approved for the site that addresses the removal of the PV facilities, BESS containers and all other infrastructure post operation phase. The decommission plan should address aspects such as monitoring and management of invasive alien plants and erosion of the site after the activities on the site are complete.

8.1 Minimising the risk of the BESS

Batteries have a limited lifespan and if there are damaged units, there could already be "waste" batteries on the first day of commissioning. An End-of-Life plan needs to be in place before the first batteries are brought on site.

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Recommendations
HEALTH RISKS						
H1	Chronic Chemical or Biological Toxic Exposure	Batteries reached end of life and may leak.	End of Life shutdown procedure including a risk assessment of the specific activities involved. Re-purpose the units with associated Environmental impact considered. Recycle the parts. Disposal according to local regulations and other directives such as the European Batteries Directive. End of life can be predefined and the monitoring can be in place to determine if it has been reached. Affected by temperature and time, cycles.	Environment damage from heavy metal ions.		
H2	Noise	As for Construction & Operational Phases				
H3	Environmental					
H4	Psychological					
H5	Ergonomics					
SAFETY RISKS						
S1	Fire	Transport of used/damaged batteries poses more risk of damage occurring and thermal runaway.	Used / damaged batteries requires specific procedures as they may be more sensitive than new batteries Confirm if batteries should be stored long term in a discharged state or 50% charge.	Thermal run away on-route or at new location.	Procedures for handling damaged or discharged batteries, modules, racks etc. Considering that they may have damage and be prone to thermal run away, leaks and other failures.	
S2	Explosion	As for Construction & Operational Phases				
S3	Acute Chemical or Biological Toxic Exposure					
S4	Acute physical Impact or violent release of energy					
S5	Generation impact					
ENVIRONMENTAL RISKS						

No	Hazardous event	Causes	Suggested preventative measures	Consequences	Suggested protective, mitigation measures	Additional Recommendations
E1	Emissions	As for Construction & Operational Phases				
E2	Pollution					
E3	Waste of resources					
GENERAL RISKS						
G1	Aesthetics	As for Construction & Operational Phases				
G2	Financial	As for Construction & Operational Phases				
G3	Security	Possible theft of batteries set aside of re-purposing or disposal				
G4	Emergencies	As for Construction & Operational Phases				
G5	Legal compliance	Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with.	Refer to EoL plan above.			

CHAPTER 9: CONCLUSION

In conclusion it should be noted that the LEMPR should be regarded as a living document and changes should be made to the LEMPR as required by project evolution, while retaining the underlying principles and objectives on which the document is based. Note that any significant changes to the EMPR must be approved by DFFE as per relevant legal requirement at that time.

The compilation of the LEMPR has incorporated impacts and mitigation measures from the EIR as well as incorporating principles of best practice in terms of environmental management. By identifying the potential impacts, mitigation measures, performance indicators, responsibilities, available resources, potential schedule and verification responsibility, the LEMPR has provided a platform on which both the construction phase and the operational phase EMPRs can be founded.

The EMPR has been updated according to the stipulations in the EA dated 8 August 2014 and includes all relevant conditions and requirements described in the original EMPR.

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